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Volume 58
Number 11

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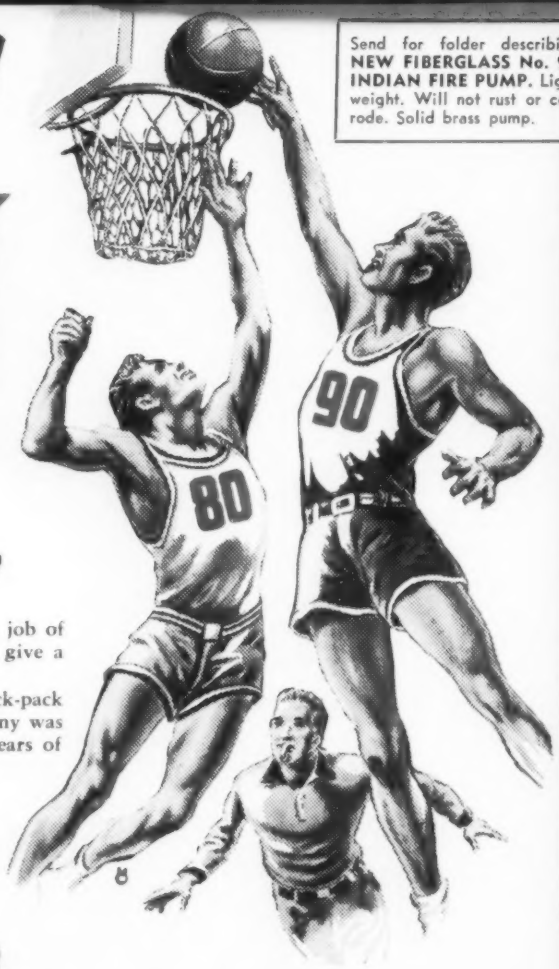

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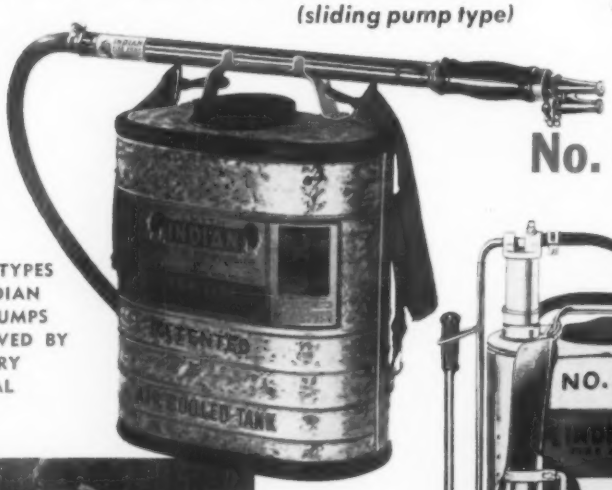

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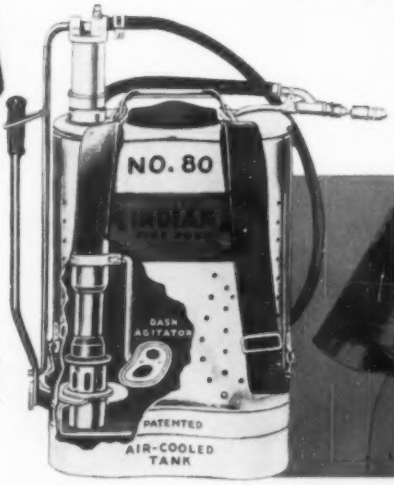

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Journal of Forestry

Official Organ of the Society of American Foresters

Highlights of the Fifth World Forestry Congress

NEARLY 2,000 registrants from 65 nations and six international organizations attended the Fifth World Forestry Congress in Seattle, Wash., August 29-September 10. Of these, some 700 were delegates from outside the United States.

It was the largest gathering of foresters ever held anywhere in the world.

Secretary of Agriculture Ezra Taft Benson was principal speaker for the Congress' opening ceremony in the University of Washington's Meany Hall, gay with flags of all participating nations hanging from its horseshoe-shaped balcony. "Your challenge," he said, "as forestry leaders of the world, is to provide for the future by making forests contribute to peace and plenty for all mankind."

B. R. Sen, director-general of the Food and Agriculture Organization of the United Nations, declared that foresters have a special responsibility and moral obligation to help conserve forested lands which he called "one of the most important natural resources for mankind." He pointed out that the Fifth Congress was being held at a time when the world is faced with "the problem of explosive population growth relative to economic development," and he emphasized that forestry must meet the needs of an expanding world population.

It was clear that both speakers believed it important that the Congress accomplish its goals of advancing the science and practice of forestry and of stimulating international cooperation in developing and using the world's forest resources.

The three-dimensional replica of the Congress shield. The 20-foot Douglas-fir served as the symbol of the world's forests.

For Congress delegates who had made the long journey to Seattle from every corner of the world, it was an opening session of many highlights. Before the Congress was called to order, a pageant titled "A Salute to the Forests of the World" was beautifully staged with lighting and background music. As the curtains parted in the darkened hall, spotlights revealed a forest panorama of living trees and shrubs stretching 60 feet across the stage and dominated by a three-dimensional replica of the Congress shield. Within the giant shield stood a 20-foot Douglas-fir as a symbol of the world's forests.

The light grew stronger, as at dawn, and three Boy Scouts made their way through the forest, stopping to salute the tree in appreciation of forest recreation before going to their campfire and tent tucked among the smaller trees. Other resources of the forest—wood, wildlife, and forage—were then played out in pantomime with a logger, a hunter, and a rancher each paying his respects to the forest. The climax came as a backdrop curtain slowly uncovered a waterfall. The presentation was an illustration of the Congress theme, "Multiple Use of Forest Lands."

After the pageant, Richard E. McArdle, chairman of the Organizing Committee, officially called the Congress to order. Remarks of welcome were extended to the Congress by Charles E. Odegaard, president of the University of Washington; Seattle's Mayor, Gordon S. Clinton; and the Governor of Washington, Albert D. Rossellini.

The ceremony ended with the presentation of commemorative postage stamps issued in honor of the Congress by the United States and the United Nations. L. Rohe Walter, special assistant to the Postmaster General, presented the U. S. stamp and Dr. Sen presented the U. N. commemorative.

Officers of the Congress

At the first plenary session the delegates unanimously elected the following officers for the Congress:

The opening plenary session.

Lord Radnor, chairman of the United Kingdom Forestry Commission, plants an English oak in the International Friendship Grove.

Honorary Presidents, Eino Saari, Finland; and C. R. Ranganathan, India.

President, Richard E. McArdle, United States.

Co-Presidents, John D. B. Harrison, Canada; and Enrique Beltrán, Mexico.

Vice Presidents, Walter Mann, Germany; Hitoshi Yamasaki, Japan; Erik Wilhelm Höjer, Sweden; The Earl of Radnor, United Kingdom; and Anatole Borisovich Zhukov, Union of Soviet Socialist Republics.

Tree Planting Ceremony

A colorful feature of the Congress was the planting of the International Friendship Grove at the Campus Parkway on September 3.

Led by the Third Marine Aircraft Wing Band, delegates from 65 nations marched down the parkway each accompanied by a Boy Scout color bearer and a Girl Scout or Camp Fire Girl carrying a shovel.

As they reached their appointed places, Henry Schmitz, president emeritus of the University, acted as master of ceremonies. Egon Glesinger, director of the FAO Forestry and Forest Products Division, gave the roll call of the nations.

The dedication, by Charles E. Odegaard, president of the University, was followed by remarks by C. R. Ranganathan of India, president of the Fourth Congress, and by Eino Saari, president of the Third Congress.

The trees, so far as possible, were grown from seed originating in the participating nations.

Delegates registering for the Congress.

Educational Exhibits

More than one hundred educational exhibits and about seventy-five motion picture films were displayed during the Congress in Anderson Hall, the home of the College of Forestry.

Ranging from displays of literature to large booths containing illuminated slide pictures, sound effects, and motion pictures, the exhibits featured many aspects of natural resources. Twenty-five of the exhibits were by foreign agencies.

The motion pictures were from many nations. A time schedule for showing the various films was an-

nounced each day in advance.

Equipment Exhibits

A popular feature of the Congress was the exhibit area where 70 companies, some from foreign nations, showed the latest products in forestry instrumentation, equipment, and machinery. Included were tractors, trucks, road building equipment, steel spars, log loaders, wood chippers, debarkers, electronic control systems, power units, and portable mills and machinery. Fire fighting tools, optical instruments, scientific accessories of many kinds, and hand tools were shown.

The exhibits were displayed at the University of Washington football stadium.

Tours

Two pre-Congress and five post-Congress tours in the United States, as well as a special post-Congress tour in British Columbia, were made available to the foreign delegates.

The two pre-Congress bus tours had 130 participants. Tour 1 of 7 days duration covered 900 miles from New York City through New York State and New England and return. Tour 2 of 12 days duration covered 1,200 miles from southern California north through Oregon and Washington to Seattle.

The tree planting delegates accompanied by flag and shovel bearers.

The five post-Congress U. S. tours with 200 participants were organized as follows: Tour 3 of 6 days duration covered 800 miles through Minnesota, Michigan, and Wisconsin; Tour 4 of 6 days duration covered 750 miles from Memphis through Arkansas and Louisiana to New Orleans; Tour 5 of 6 days duration covered 900 miles from Spokane, Wash., through Montana, Wyoming, and Utah; Tour 6 of 5 days duration covered 700 miles from Phoenix through Arizona and return; and Tour 7 of 6 days duration covered

Anderson Hall, home of the College of Forestry, housed the educational exhibits.

Delegates in native costume at the plaque identifying the International Friendship Grove.

A portion of philatelic exhibit showing postage stamps with pictures of woodlands, forest industry, and flowering trees of the world.

2,000 miles by airplane from Seattle to Alaska and return.

The Canadian tour was of 5 days duration by bus from Victoria north into Victoria Island and terminating in Vancouver. It had 45 participants.

In addition, 6 all-day and 9 half-day tours were scheduled during the Congress to enable delegates to visit major forest areas and forest industries within 250 miles of Seattle. These tours contributed greatly to the visitors' enjoyment of the Congress and to their knowledge of American forestry.

The Proceedings

Approximately 450 papers, including 200 invitation papers and about 250 additional volunteer papers, were presented in full or by title during the 3 plenary, 3 general, and 39 technical sessions. All speeches, papers, and commentary were in the three official languages of the Congress—English, French, and Spanish.

These documents will be published in an official *Proceedings*, probably in three volumes, in 1961.

The following summary of work and recommendations of the technical sessions is published for the information of the forestry profession. This report was approved at the third and final plenary session on September 10. The total final report of the Congress will appear in full in the *Proceedings;* it will have five chapters of which this will be one.

B. R. Sen, director general of the Food and Agriculture Organization, presents the United Nations commemorative stamps to William M. Gibson of the Office of International Conferences, Department of State, who was vice chairman of the Congress.

Multiple Use of Forest and Related Lands

The central theme of the Fifth World Forestry Congress was the "Multiple Use of Forest Lands."

Management of the forest in a manner that will conserve the basic land resource, while yielding a high level of production in the five major uses —wood, water, forage, recreation, and wildlife—for the benefit of the greatest number of people in the long run, was recognized by the Congress as constituting the multiple use of forest and related lands. This concept had passed into everyday usage in the United States as the way toward meeting the urgent wants and needs of a rapidly growing population in a dynamic economy.

The Congress stressed that the concept of multiple use is not a panacea to solve all forest management problems. It recognized that often one use must be dominant and that in such cases other uses are permissible if they are not to the detriment of the major one. The application of multiple-use principles and opportunities for their practice were examined in broad terms by representatives of several nations.

From India came a description of the polyvalent role of forests within a wide variation of geographic patterns in supplying an expanding industry and in preventing erosion and floods and deterioration of environment. The disadvantages of multiple use when it is inefficiently applied were also mentioned.

Certain aspects of the forest policy of the U.S.S.R. showed that traditional concepts such as sustained yield could and should be adapted to the needs of the country's entire economy. Here, special emphasis has been given to shifting certain activities from overused forest areas to underused forest lands. It was stated that it is

Ram Bahadur Thapa of Nepal, Sir Arthur Gosling of the United Kingdom, and Risto Olavi Sarvas of Finland, examine a Forest Service smoke jumper's outfit.

A portion of the equipment and machinery display.

not only through the production of wood but by means of all other "forest values" (of multiple use) that the expansion of the forest domain plays a predetermined part in the expansion of the nation's prosperity as a whole.

From France, Venezuela, and certain other countries came general recommendations that economic, social, and physical criteria all be considered in determining forest land management procedures. An analysis of these criteria leads in a majority of cases to the determination of relative priorities in use. The Congress was informed about the timber industry's vital concern with multiple use on privately owned forest lands in the United States.

The presentations and discussions at the general sessions made three things clear: (1) the multiple use concept has world-wide recognition as an important goal of forest management; (2) its practice varies greatly under different conditions, not only as between countries but in the same country; and (3) opinions differ as to how and when multiple use is actually being practiced.

The Congress agreed that the multiple use concept presented new challenges and new opportunities to foresters everywhere with great prospect for additional services to the health and welfare of mankind. It accordingly adopted the following resolution:

THE CONGRESS CALLS on all governments to study, develop, and encourage sound concepts of multiple-use management as a means of providing optimum satisfaction of human needs from forest and related lands; AND URGES the various Nations of the World to accelerate the exchange of information on their experiences and conclusions in the development of their multiple use programs.

Progress in World Forestry

The Congress reviewed broadly region by region the progress that had been made in forestry, in the widest sense of the term, since the Fourth World Forestry Congress held in India in 1954.

In introducing the various statements presented, the President expressed the hope that this kind of review would be a feature also of future World Forestry Congresses.

In general, over recent years there had been considerable and commendable progress in all the various aspects of forestry and forest industries development throughout the world. But considering primarily wood production, the progress in the main had been, as with agriculture, in the already highly developed areas of North America, Europe, and in the Union of Soviet Socialist Republics. In the so-called underdeveloped parts of the world production had not risen as was hoped. Indeed, the failure for output and consumption to rise in these areas, as should be warranted by population expansion, better living standards, and greater industrial needs, was the great disappointment of the past decade. Needs would continue to grow, and governments must more readily take them into account in their forward planning. Otherwise, housing plans, literacy campaigns, mass distribution of food and goods through packaging would be severely handicapped or enormously expensive.

In Europe over the past few years strong attention had been given to land use planning, soil protection, and the conservation of water at source and protection against pollution. In the Union of Soviet Socialist Republics, expanded production, especially of pulp and paper, was prominent. In the Near East, lack of professionally trained staffs and technicians hampered resistance to the pressure to turn over forest land to other uses and grazing. The Far East was concerned with getting wood requirements from surplus areas to the deficit areas with their explosive populations. In Latin America, the aim was to make its particularly enormous forest wealth yield im-

At the Department of State reception. L to R, Stephen Tolbert, head of the delegation from Liberia; Henry Clepper, executive secretary, and Charles A. Connaughton, president of the Society of American Foresters; and Henry Schmitz, president emeritus of the University of Washington and honorary vice chairman of the Congress.

Participants on the Lake States Tour.

mediate returns. Industrialization often must precede management for which trained staffs, properly remunerated, were badly needed. A degree of accelerated harvesting of forests was warranted to finance future development programs.

The major problem in North America was organizing total production—in the United States of America through the great number of private forest owners and in Canada by controlled exploitation of the public forest lands. In Canada, the creation of a Federal Ministry of Forests was a development greatly welcomed. In Africa, the national forest domains need to be retained or expanded. International aid on a large scale is needed.

As a result of its review of the world situation, THE CONGRESS RECOMMENDED to governments, to FAO, and foresters everywhere that during the coming years special attention be given to:

1. Systematic studies to develop methods for evaluating intangible forest values in quantitative terms;
2. Research and experimentation with quick-growing species or genetically superior stock for planting programs in temperate and tropical countries;
3. A gradual spreading of pulp and other forest industries in the underdeveloped regions;
4. Training of forestry technicians and administrative staffs; and
5. The systematic encouragement or adoption at the national level of quantitative plans for forest production and development geared to prospective requirement for forest products.

Silviculture and Forest Management

Under the field of silviculture and forest management, the Congress considered inventories of forest resources, semiarid and arid land forestry, modern concepts and advances in silviculture and forest management, and forest ecology and soils.

THE CONGRESS RECOMMENDED intensification of research in the adaptation of aerial photography to the peculiar problems of tropical inventories and in the development of more efficient techniques for collecting and analyzing the precise data required in intensive forest management. The need of developing coordinated inventory procedures in the measurement of multiple forest values was advanced. The marked recent progress made in the application of machine processing of forest-survey data was noted, including the shift towards electronic computers which permit processing data within days, or hours, as compared with earlier much slower and more costly methods. FURTHER RESEARCH WAS RECOMMENDED to develop more efficient techniques for application to inventories of extensive forest areas and to varying levels of survey intensity.

The discussion of semiarid and arid land forestry revealed the difficult problems encountered in the integration of forestry and grazing, in the restoration of vegetative cover in regions subject to heavy grazing, and especially in the establishment of needed wood-production forests for local populations. Views favoring the establishment and intensive management of forest areas as required on good soils were expressed. Such forest tree orchards are planned to produce a given product or given products necessary in the region. The improving of the grass or tree cover on areas of poor land now supporting shrubby growth was also suggested. Tree planting on such areas should be considered after viewing the probable adverse water balance caused by tree vegetation. In recognition of the pressing needs for forestry measures in many dry regions of the world, the Congress recognized the need for intensified studies of the diverse and difficult problems involved.

The topic of "forest tree orchards" versus "naturalistic" silviculture brought out differing opinions relative to how far foresters can safely depart from "natural" forest conditions. Studies should be made over a long period on the same site. Appropriate roles for both concepts in forest management were recognized. Foresters need to understand the biogeocenotic relations of the forest and apply silvicultural concepts and procedures based on the knowledge of natural laws. The traditional silviculture methods result in multiple use. In discussing the planning and control of managed forests, attention was given the most advanced procedures followed in Europe and North America, including the large-scale application of permanent sample plot systems as a method of inventory control. Discussion of the influence on silviculture or delivered prices of forest products explored present and expectable limitations on the intensity and costs of silvicultural treatment imposed by market factors. New methods in controlling stand composition were discussed, particularly those per-

taining to control of undesired species.

In the field of forest ecology and soils, the Congress reviewed recent progress in classification and mapping of sites, intensive soil management for increased wood production, and the relation of tree diseases to soil management.

INTENSIFIED RESEARCH WAS RECOMMENDED on forest productivity rating systems. The increasingly important role of soil improvement practices was recognized. The concept of the forest as a dynamic ecosystem received much support. The nutrient cycle and its modification through silvicultural practices were discussed. The importance of the ecosystem concept was stressed in reviewing progress on indirect estimation of forest site productivity from measurements of ecological factors. The significance of understanding the underlying relationships between site productivity and all of the factors of the ecosystem which influence it were recognized. Such knowledge permits prediction of the potential site for different species and provides a basis for estimates of the potential productivity of different forest regions of the world and their future role in meeting world needs for forest products.

The Congress recommended the following with respect to expansion of the forest typology activities of the International Union of Forest Research Organizations:

1. That the working group program in forest typology of IUFRO be expanded to include other methods of forest typology, the majority of which were discussed at the ecosystem symposium of the Ninth International Botanical Congress, in order to reach practical conclusions in such a way that these methods could be compared and used for the needs of forestry.

2. That this working group present methods of evaluating the multiple uses of forest land using combinations of forest, soil and climate features with such concreteness that they may be applied by practicing foresters.

OTHER RECOMMENDATIONS adopted by the Congress were: (1) Establishment by FAO of uniform procedures for recording and registering essential data on experimental forest plantations; (2) investigating the possibility of obtaining preferential rates for air transport of forest seeds and plant material intended for experimental use; (3) promoting a campaign of "Forests for the Year 2000" to assist in the reservation or creation of forests in countries where forestry is not well developed; (4) control of goat grazing on forest lands; (5) the creation and treatment of forests of proper biogeocenotic condition in different countries; (6) research to make clear how far we may deviate from nature in our forest cultivation; (7) studies in forest tree orchards should give guidance to how long-term plantations could be grown efficiently.

Genetics and Tree Improvement

The Congress reviewed progress in tree improvement and discussed proposals for international cooperation in genetics research and related activities. General agreement was reached on the need for strong cooperation in the exchannge of breeding materials and in seed certification. Several alternatives were discussed which varied from a system of voluntary cooperation to a rigidly enforced International Code endorsed by member nations.

The Congress recognized the need for action to utilize fully forest tree improvement to strengthen afforestation and regeneration programs and to further the diverse objectives of multiple use. It, therefore, RECOMMENDED that a world-wide technical conference be organized by FAO with the support and endorsement of the International Union of Forest Research Organizations and similar bodies, to coordinate and promote at an early date the development of forest tree improvement techniques, the mass production of improved planting stocks, and the adaptation of such techniques and materials to afforestation and regeneration programs on a scientific and rational economic basis.

The Congress supported efforts to standardize the naming of plants and RECOMMENDED in the interest of international cooperation, the use for forestry of the International Code of Nomenclature for Cultivated Plants.

THE CONGRESS RECOMMENDED that FAO take action to develop an international agreement to facilitate exchanges of breeding material, especially for experimental purposes.

Delineation of the objectives of forest tree improvement and the discussion of attainment of these objectives brought out the importance to genetics of basic research in supporting sciences. The Congress recognized that tree improvement through selection, hybridization, through polyploidy and mutagenesis, and influence of environmental factors offers exciting opportunities for the forests of all nations.

Forest Protection

The Congress reviewed recent progress in reduction of losses from forest insects, diseases, and fire. There is a definite and direct relationship between weather and climatic variations and the occurrence of destructive insect and disease epidemics and disastrous fires, making it possible to predict dangerous periods and to plan for extra precautionary procedures. Progress was reported on the possibility of reducing lightning occurrence, a major cause of serious forest fires.

New approaches to improved chemical biological, and cultural control of forest insects were discussed. The need was stressed for more basic information on life histories of forest insects and other forest fauna, for more selective insecticides, and for more effective methods of application. The success of past explorations for, and introductions of, parasites and predators of forest insects has demonstrated the value of biological control,

The Society of American Foresters exhibit prepared by the Puget Sound Section.

particularly for species introduced into North America. Continuing research on insect pathogens indicates the increasing usefulness of virus, fungus, and bacterial diseases for control of certain groups of forest insects. Some degree of protection from harmful forest insects can be secured by maintaining natural forest species mixtures, by removing susceptible trees, and by thinning or other cultural treatments to promote tree and stand vigor and to favor protective biotic agents. The most effective forest insect control can be obtained by integrating chemical, cultural, and biological practices.

The need for better knowledge of how to protect forests against fire is receiving increased attention because of the increase in world demand for forest products. One critical problem in meeting fire control objectives is to maintain flexibility in the fire fighting organization. It must be economical, yet capable of meeting critical emergencies. This is accomplished in Australia through a nucleus of fire fighting specialists augmented as needed by local residents and forest workers. Another way of meeting this need is through mechanization and the development of new and improved chemicals. Aircraft are now used widely in the United States and Canada both for quick movement of men and for direct fire attack. The Congress considered the role of research in the development of better fire control. Special needs for data on forest fire behavior were given recognition, and recent studies in this area were reported.

Catastrophic losses have been caused on all continents by diseases introduced from other continents. To prevent similar occurrences in the future, there is need for more information on the diseases of all continents, on how they may be recognized, on the susceptibility to them of important tree species of other continents, and for improved quarantine procedures.

Protective and eradicative toxicants long used in agriculture are now available for control of diseases in forest nurseries, plantations, and managed stands. They include organic fungicides, selective phytocides, soil fumigants, and systemic antibiotics. These chemicals offer a promising new approach to the direct control of forest disease. Root rots of forest trees may be characterized as "management diseases" because their occurence is directly related to the intensity of forest management. Control may be secured either through changes in silvicultural practices or through special direct action programs.

THE CONGRESS STRONGLY RECOMMENDED that research should be stimulated to determine the fundamental factors responsible for pest outbreaks and catastrophic fires and to improve preventive and control measures.

Forest Economics and Policy

Forest economics and policy discussions at the Congress dealt with subjects of broad general interest involving situations and problems common to most countries represented; namely, policy and economic problems in the conversion of old-growth stands to managed forests; significance of supply, demand, and marketing analysis in formulating forest policy; institutional arrangements for forestry; and how to achieve better management of small woodlands.

The discussion brought out that the problem underlying forestry advancement in most countries is basically one of inadequate local markets. In many areas of the world, particularly the so-called underdeveloped countries, timber for fuel is the principal local use with the accessible old-growth being "creamed" for quality export material. Often these countries have a great wealth of timber, yet they import most of the timber, pulp, and other primary forest products they so desperately need and could readily supply from their own resources. Indeed, forestry progress may languish unless substantial local markets for a variety of needed products are developed in these timber-rich countries. The heavy inroads made by competing materials is another major handicap. Studies of supply, demand, and marketing of forest products are essential to forward planning in all countries in order that the necessary steps are taken to foster forest development and to satisfy the probable long-range timber requirements and to maintain wood and wood derived materials in a competitive market.

Private forests play an important role in the timber economy of some countries. Some countries have decided they cannot afford to leave the future of their private forests solely to the devices of the owners unless the private landowner has accepted appropriate land proprietorship. Generally, large private ownerships do a good job of managing their timber holdings. But with the exception of certain regions this, unfortunately, is not the case with all small forest ownerships which hold a large percentage of forest land the world over. In a large part, these small forest holdings are owned by farmers and others not associated with any forest industry. Their main productive activity is generally not growing timber. The Congress reviewed various approaches to getting better management applied to small forests. IT STRONGLY RECOMMENDED that the most acceptable approach involves such measures as intensive education and various forms of public support and assistance.

Education

The problems and needs in forestry education for countries with newly developed forestry programs were examined in terms of the type and scope of institutions needed, and the manner in which public support for such institutions might be effectively achieved.

The great need for trained men at both the technical and professional levels, especially in tropical countries, was repeatedly emphasized. The Congress was greatly concerned about the capacity of existing schools to meet demands. Countries should intensify their efforts to secure professional training for their most competent men. The Congress recognized that for some countries the best course may be to send their men to well-established forestry schools in other lands. The Congress recommended that strong regional centers for education and research be set up in areas of emerging forestry activity. Ranger schools and similar institutions for training technicians should be the concern of each country. THE CONGRESS RECOMMENDED that FAO and other appropriate agencies favorably consider requests for assistance with financing and staffing, at both types of institutions.

THE CONGRESS RECOMMENDED that all countries set as an early goal the development of a strong nucleus of men trained at institutions with full university status. Such a nucleus was deemed to be essential as a prerequisite to the establishment of ranger schools and professional schools within a country. Also, forestry must attain the prestige which only a highly competent, professionally trained cadre of men can give. Such prestige and respect are required in order to exert the necessary influence to elevate forestry to a high level in the eyes of people and their governments.

The Congress expressed the need for more professional foresters trained in the economic aspects of forestry. There was no question that scientific

experts are essential to the development of modern technologies. But countries also have need for men capable of making broad appraisals of various economic factors that will influence decisions in the orderly, planned development of a forestry program. THE CONGRESS RECOMMENDED that special effort be made by international organizations and other agencies to train such men. The Congress also recognized the need for training more teachers capable of organizing and directing curricula in forestry education at all levels.

It was also emphasized that in most cases it is inadvisable to attempt to train specialists in the undergraduate years. What is more important is to provide a solid foundation of basic sciences and forestry principles. Specialization can best be accomplished by graduate study. The sentiment of the Congress was that graduate schools should usually not be established in newly developing countries.

Existing schools with well established faculties and facilities can absorb additional numbers of students. These, together with the new tropical educational and research centers recommended, can serve for the immediate future. As a special device to supplement advanced training, it is RECOMMENDED that FAO might organize and conduct regional seminars for exchange of information among foresters from ecologically similar regions.

THE CONGRESS RECOMMENDED that some forestry schools or special institutions give instruction in world forestry to prepare teachers and technologists to staff missions abroad sponsored by FAO and other agencies.

The Congress recognized that advancement of forestry depends on broad public understanding and support. Substantial success has been achieved in enlisting support in a number of countries, using a variety of methods. THE CONGRESS RECOMMENDED that these methods be studied and adapted to local conditions by countries needing to strengthen their public education program.

Forest Products

The role of forest products research in promoting the economy of undeveloped forest regions, in making forest supplies go further, and in making improvement cuttings practicable was emphasized in the diverse subject matter relating to forest products dealt with by the Congress.

The latest findings on the intimate structure of wood, as revealed by the electron microscope, and the relation of structure to physical and mechanical properties were considered. Progress in the chemical characterization of wood was reviewed, with emphasis on the characteristics of cellulose and lignin and their relationship to molecular structure, and on the diversification of products from chemical conversion. Included also were discussions on the importance of wood quality and factors that affect it; progress and automation in wood processing; the potential of integrated utilization; the significance of wood preservation and protection; and progress in the development of increased pulp yields and new pulp sources, especially in improved utilization from broadleaf trees.

The Congress, in recognizing the diverse contributions of research in forest products to improved utilization and its impact on forestry, viewed as a salutary factor the interest in establishing forest products research laboratories in additional countries. THE CONGRESS RECOMMENDED a widening of forest products research effort by governments, educational institutions, and private agencies.

The multiple-use concept of the forest has as a counterpart the diverse use of forest products. This, in turn, results from the great variation in species characteristics and a wide range of wood quality within species. The Congress recognized the importance and the potential of improvement in wood quality from the utilization standpoint through improved genetics and silviculture, and RECOMMENDED continued and expanded research effort in this field.

The review of progress made in the efficiency of wood use through integrated utilization has reaffirmed the importance of that approach. THE CONGRESS RECOMMENDED that continued effort and cooperation among industries be encouraged to further the potential of integrated utilization, and that research be continued to facilitate its further development.

The substantial increase in the use of many forms of wood residues as a means of effecting more complete utilization was recognized by the Congress. It was emphasized that sawdust in its present form and shape presents perhaps the greatest problem in achieving satisfactory utilization. THE CONGRESS RECOMMENDED that research on the utilization of wood residues be continued, and that increased effort be given to redesign of saws that will afford longer-fibered sawdust chips of more usable form, without adversely affecting the cutting rate and production costs.

In the pulp and paper field, great progress has been made in recent years in appreciably increasing yields of certain pulps by the development of the semichemical, chemi-groundwood, and cold caustic soda processes, and research has shown the potential of broadening the species base by the pulping of hardwood species.

The Congress recognized the need for increasing pulp and paper utilization in many regions, and recommended increase in the research effort to improve pulping methods for broadleaved species, particularly mixed hardwoods, to meet the challenge for development of new pulp sources.

The Congress recognized the enormous drain on the forest resource and the reduction in serviceability of wood and wood products through decay organisms, and the importance of wood preservation and protection in decreasing this drain and in increasing the serviceable life of wood products by preservation. THE CONGRESS RECOMMENDED that every effort be made to disseminate available information on wood preservation and protection, and that vigorous research be continued to develop new toxic preservatives and improved methods of treatment that will assure adequate penetration with a minimum adverse effect on mechanical properties.

The Congress took cognizance of the great increase in the production of fiberboards and particle boards throughout the world, and the significant effect of this development on improved utilization, particularly of wood residues. The Congress recognized that these developments have resulted from extensive research to further broaden the utilization of residues, develop improved products, and reduce costs.

The current research findings on the chemical composition of wood and its constituents reemphasized the complicated nature of wood, the great variety of component derivatives that can be segregated, and the broad potential for chemical conversion of wood residue into diverse and useful products to increase the efficiency of wood utilization. THE CONGRESS RECOMMENDED the extension of basic chemical research to broaden the knowledge of the chemical constituents, particularly cellulose, chemi-cellulose, lignin, and extractives.

THE CONGRESS RECOMMENDED fur-

ther that plans be made to arrange, at appropriate intervals, meetings of directors and other research leaders of the various government and other forest products research laboratories and organizations, to review research progress and coordinate, as far as possible, their diverse research programs.

Forest and Range Watersheds

The Section held three meetings during which four broad general subjects were discussed. During the discussion on protection forests, the participants were impressed by the similarity of problems of avalanches, floods, and sedimentation as represented by reports from Japan, India, and the Alps. But it was also revealed from papers and discussions that there were considerable differences in the methods used to correct or alleviate torrential erosion, floods, and sedimentation in sectors around the Mediterranean. While forests play an important part in stabilizing soils and reducing flood runoff, it was demonstrated that in certain critical situations reforestation must be supplemented with structural measures such as contour terraces, channel barriers, levees, diversions, and similar devices.

The discussion on shelterbelts showed that such plantings have proved effective in reducing wind erosion, evaporation, and damage to crops from blowing soil, and in ameliorating local climate. There appears to be some conflicting evidence as to the most effective pattern and design of shelterbelts. It was pointed out that the most effective design as found from long experience varies greatly from one locality to another.

The session on management for water production produced considerable interesting discussion as to the effect of forests on water yield and streamflow regime. The character and condition of the forest plays an important part in influencing the amount and timing of water flow. Where a particular watershed constitutes the primary source of water for a municipality, special management techniques and objectives may be required, and in some situations multiple use should be approached with care to avoid damage to water quality. The amount and timing of water yields may be appreciably altered by changes in density, pattern, or composition of the vegetative cover.

Such activities as logging and grazing must be carried out with due consideration of their possible effects upon storm runoff and erosion. On steep unstable mountain areas, special measures to remove logs, such as overhead cable, may be required to prevent excessive soil disturbance. Grazing should be guided by proper distribution of animals, a system and timing of use so as to maintain a good cover of desirable forage species.

THE CONGRESS RECOMMENDED that the primary land division for management planning purposes should be one that best promotes water conservation, water control, and local climate modification; this would indicate the watershed, drainage basin, or catchment as the most desirable planning unit. IT WAS AGAIN RECOMMENDED, as had been done by previous World Forestry Congresses, that foresters should actively participate in all such planning activities.

Forest Recreation and Wildlife

The Fifth World Forestry Congress was the first to include a Section on Recreation and Wildlife on its agenda. The decision to do so rounded out the consideration of the multiple use of forest lands. In view of the keen interest shown on this subject, the hope was expressed that this topic would be a feature also of future Congresses.

The subject of forest recreation and wildlife was developed in three sessions, emphasizing recreation, wildlife, and reserves respectively. Although each session was complete in itself, there were common elements that applied to the others.

The public use of forest area for recreation is expanding at an unexpected rate in many countries. Although regarded as a desirable form of public enjoyment of the outdoor values of forests, the increased numbers of people in the forests has emphasized several management problems. These include such matters as fire, damage to flora, and how to manage great numbers of people.

Some nations are faced with the problem of overuse of national parks by people, whereas in some other regions the need is to establish parks and place them under administration. Discussions brought out that the primary reasons for parks and reserves will vary with the special values needed to be safeguarded. In much of Africa at the present time attention is focused on reserves for wildlife. In several places in the world, the desirability of international parks and reserves on the boundaries of neighboring countries was mentioned.

A number of countries, notably in western Europe, have nature protection laws that set the national policy and program. Some of these laws provide for zoning of private lands to maintain a pleasing landscape.

Forest wildlife was recognized as an integral part of the forest. Papers and discussions brought out that from a recreational and ecological point of view all animals may be of importance. It was pointed out that many animals are far from neutral elements of the forest complex, since big game, rodents, and seed eating birds may interfere with forest regeneration. The management directives on forest game animals differ from place to place, and while there are, on the one hand, forest areas in both hemispheres where increased harvest of game animals is warranted, there are others where total disappearance of some species of wildlife over large tracts can only be averted by careful conservation.

THE CONGRESS MADE THE FOLLOWING RECOMMENDATIONS:

1. Forest recreation and managed wildlife should be recognized by government as acceptable forms of multiple-use management of forest lands.

2. All forms of animal life affect or are affected by the forest, and understanding of their roles in the forest should be made more widespread.

3. Research in forest recreation and wildlife should be provided to furnish additional information to cope with the growing problem of public use, site damage and wildlife management.

4. Public information media should be used to encourage the appreciation and protection of outdoor values, and the understanding that wildlife may need to be utilized in some areas and protected in others.

5. International cooperation in the preservation of nature and wildlife reserves in contiguous border areas is strongly recommended.

6. To assist in new programs of reserves and wildlife management, technical assistance be made available to the new nations of Africa and to other nations through international agencies.

Logging and Forest Operations

Many aspects of planning and management of operations for a wide range of size of enterprise in many forest regions were discussed by the Congress. While it was quite evident that the methods of one region can seldom be successfully transposed to other regions with differing forest,

social, and economic conditions, the exchange of experiences on how operating problems have been solved for various specific conditions does develop basic principles which are helpful to those concerned with management of operations of every size in any country. The necessity in every circumstance for plans in advance, based on an adequate inventory of timber resources, of the expected costs and returns of the operation, and the silvicultural and protection requirements to maintain a high rate of productivity for the forest property was a common theme of the discussions on various phases of logging, logging road construction and use of cableways in every quarter of the globe.

The Congress was deeply concerned with recruitment, training, safety, and welfare of forest workers. The numerous factors which make for more and greater obstacles to social progress in forestry than in most other industries were developed, but the evident consensus was that foresters are responsible for social progress of forest workers.

The development of working techniques and the training of forest workers through the coordinated efforts of the Food and Agriculture Organization's European Forestry Commission, the United Nations Economic Commission for Europe, and the International Labor Organization were discussed at some length. The sentiment of the Congress was that the accomplishments of the joint committee fostered by these three agencies have been excellent, and that this type of activity should be intensified and expanded to other forest regions, particularly in underdeveloped countries.

The Congress recognized that training and safety are so closely related as to be virtually inseparable for systematic consideration. Accordingly, the Congress, recognizing that forestry work, including the various phases of timber extraction, ranks among the most hazardous of occupations, RECOMMENDS:

1. Greater efforts on the part of governments, employers' organizations, and workers' groups in the prevention of accidents.

2. Activities connected with safety programs now in operation in the various countries and the work in this field at the international level should be continued and expanded, particularly in the exchange of experience between countries on the human factor, safety instructions in vocational training, forest accident statistics, and safety equipment.

THE CONGRESS RECOMMENDS that international training courses, fellowships for personnel desiring to study abroad, publications on training, manuals on work techniques and equipment, development of testing procedures for forest machinery, and encouragement of research in improvement of work efficiency should also be continued and expanded, and that appropriate international organizations give attention to coordination of such matters.

Tropical Forestry

The Section on Tropical Forestry considered four major topics: (1) regeneration and establishment, (2) obstacles, (3) intensive *vs.* extensive management, and (4) shifting agriculture.

Natural regeneration and planting were the subjects of spirited discussion in which the views of the delegates reflected the abundance or lack of forest resources in the areas with which they were most familiar. It was recognized both types of regeneration are needed in many areas and that they are not mutually exclusive.

A somewhat gloomy outlook of declining resources, lack of responsible management of large areas of lands, and high production costs was described. This viewpoint, apparently not accepted as realistic by all present, prompted discussion from the floor describing forestry progress in several areas as a partially counteracting development.

It was concluded that the most satisfactory system of forest land tenure in many countries is a combination of government control and the delegation to private interests over long-term periods of some or most of the responsibilities of ownership. In forest concessions, it was suggested that the major yield control decisions should remain the responsibilities of the state, that royalties be revisable in accordance with the changing volume of money, and that the concession be conditional upon the establishment of a manufacturing plant of appropriate capacity which cannot be disposed of separately from the concession itself.

As regards intensive *vs.* extensive tropical forest management, it was apparent that policies should be influenced by a number of factors, some of which are only indirectly related to the timber resource itself or the need therefor.

Shifting cultivation was highlighted as a serious threat to remaining forests in many parts of the tropics. Whereas it was accepted that under some circumstances the practice may not be entirely destructive, the problem of saving tropical forests from encroachment by the shifting cultivator was seen as a tropical forestry problem of the first order. Techniques described to meet this problem were local in their applicability. It was agreed that intensive permanent agriculture must replace shifting cultivation, not only as a better land use but also to meet more satisfactorily the crop requirements of growing populations. The foresters' task in the meantime is seen as a combination of the following: (1) obtain reservation of areas of forest lands where possible, (2) increase the productivity of forest lands, (3) develop more effective forestry practices compatible with shifting cultivation and adapted to the character of lands abandoned by the shifting cultivator.

THE CONGRESS THEREFORE RECOMMENDS:

1. That governments take steps immediately to identify those areas within their national boundaries which should remain forested and to this end seek the assistance of international or bilateral agencies.

2. That countries faced with serious problems of shifting cultivation and deforestation seek financial and technical assistance from appropriate United Nations and other organizations.

3. That permanent working groups be set up, possibly in the Regional Commissions of FAO, for the worldwide study of the problem of shifting cultivation and with the responsibility to report progress to the next World Forestry Congress.

Resolutions of the Congress

The Congress received with gratification invitations from representatives of the Governments of Spain and Argentina to host and organize the Sixth World Forestry Congress which should preferably take place in 1965. As the Food and Agriculture Organization of the United Nations customarily sponsors World Forestry Congresses, the Congress referred these invitations to the Director-General of that organization with the request that after consulting with the member governments of United Nations and Food and Agriculture Organization, he would submit to the Conference of FAO, for a decision on

the location and date of the next Congress, these invitations and any others that he might subsequently receive. (Presented by V. L. Harper [United States], and unanimously adopted.)

The Congress was greatly appreciative of the efforts of the sponsoring agency, FAO, and also of the United Nations in furthering its aims and objectives. The Congress also warmly appreciated the action of the United Nations and of governments in issuing special series of commemorative postage stamps honoring the Fifth World Forestry Congress.

Consequently the Congress unanimously adopted the following resolution:

THE CONGRESS, APPRECIATING the strong efforts made by the Food and Agriculture Organization of the United Nations, the United Nations organization itself, and their member countries, to make the Congress well attended and its aims, purposes, and results widely known.

EXPRESSES its deep gratitude to the Director-General of FAO and to the Secretary-General of the United Nations for their support and material assistance, and

REQUESTS that this expression be in turn conveyed to all member governments of these organizations who contributed so well to the value and success of the Fifth World Forestry Congress. (Introduced by J. H. Jenkins [Canada], and adopted by acclamation.)

THE CONGRESS, RECOGNIZING that the success of the Fifth World Forestry Congress owes much to the untiring efforts of many people of the City of Seattle and the State of Washington,

EXPRESSES its most sincere thanks to the President and entire staff of the University of Washington for the unstinted services that have been rendered to the Congress,

EXPRESSES, also, its warmest appreciation to the people of Seattle and the State of Washington for the remarkable welcome and hospitality which the members of the Congress have enjoyed and which will be long treasured in their memories. (Introduced by E. W. Höjer [Sweden], and adopted by acclamation.)

THE CONGRESS WISHES to record the fact that the Fifth World Forestry Congress has constituted an outstanding gathering of the world's foresters and of all concerned with forestry in its many aspects;

RECOGNIZES this as a striking tribute to the interest and respect which American forestry enjoys in today's world;

CONGRATULATES the whole organizing committee and all who contributed to its works on the signal success of the Congress;

EXPRESSES sincere gratitude to the Government of the United States of America for its great generosity in acting as host to this memorable Fifth World Forestry Congress. (Introduced by Lord Radnor [United Kingdom], and adopted unanimously by acclamation.)

Foreign Tree Diseases—Threats to North American Forestry[1]

Thomas S. Buchanan

THE IMPORTANCE of forest tree diseases to the forest economy of North America has been demonstrated time and time again. Losses of valuable forest resources caused by the unfortunate introduction of tree-killing pathogens from abroad have been and could continue to be well toward the top of any list of causes of unregulated drain. Foresters and others concerned with forest resource management are well acquainted with such devastating forest tree diseases as white pine blister rust, chestnut blight, and Dutch elm disease—all diseases of foreign origin and all now firmly entrenched throughout most of the range of their susceptible host. These people are less familiar with larch canker, however, for it fortunately was discovered soon after it arrived on the east coast from abroad and efforts to stamp it out before it could gain a firm foothold were successful. Thus another eastern and potential western forest disaster was averted.

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[1]Adapted from a paper presented at the 7th International Forest Disease Work Conference, Pullman, Wash., December 2, 1959.

Present Situation

Countrywide, the score now stands at 3 to 1; three introduced major forest tree diseases firmly entrenched and but one successfully nipped in the bud. Total damage caused by these foreign diseases is difficult to appraise with accuracy. Stumpage values of timber killed outright can be determined with acceptable precision, but mortality defines only one of the losses sustained. Lowered annual increment, degrade, cull, disrupted management plans and cutting schedules, and the costs of control efforts are more important losses and they add up to a staggering amount. It is interesting to speculate as to how much further research and control efforts on native forest tree diseases might have progressed if the millions of dollars spent on white pine blister rust could have been used for other constructive purposes. Millions of acres of coniferous timber infected by native dwarfmistletoes, for example, could have been "sanitized" with resultant long-term benefits.

Characteristics of Introduced Diseases

There are two subtle features common to introduced diseases.

The first, as best typified by the introduction of *Rhabdocline pseudotsugae* needle-cast into Europe from North America, is the long time that may elapse between

original entry and unobserved buildup to epidemic proportions. Chestnut blight, as another example, was introduced into Italy from the United States, probably during World War I, but was not discovered until 1938. And referring once again to the American experience with white pine blister rust—it was not found in the West until September 1921 but subsequent study showed it had actually been introduced on nursery stock from France in 1910.

The second insidious thing about introduced diseases is that they characteristically tend to be more destructive than native ones. New suscepts, trees without previous exposure to the specific pathogen and hence without benefit of generations of natural selection for resistance, may fall easy prey. Then, too, the causal organisms, just as with humans, may and often do seem to enjoy a change of climate as well as a change of diet. Characteristically they may be more destructive in a new environment but this is not always so. For example, *Chrysomyxa ledi* var. *rhododendri* causes a destructive needle disease of spruce in its native European and Asiatic alpine habitat. That it was introduced into North America from abroad is still a question, but it could have been, for the same fungus is found on rhododendrons at several places in the West. But for the time being at least, it is perfectly harmless to native American spruces. For one reason or another it fails to produce the spruce-infecting spores on the rhododendron alternate host. The point is, in any event, that there are far more than enough serious forest tree diseases native to North America without importing any from abroad. And, of course, other countries feel exactly the same way about their situation. Right now, for example, eight countries in Europe, Asia, and Africa have rigid restrictions on the importation of oak products from the diseased area in the United States for fear of introducing oak wilt into their own forests.

Safeguards and Precautions

The ideal way to handle the problem of foreign forest tree diseases is, obviously, to prevent their introduction in the first place. Plant quarantine regulations and inspections are much more rigid and efficient now than when white pine blister rust and chestnut blight gained entry many years ago. This improvement can be illustrated by citing an inquiry recently received from federal quarantine people as to what risks there might be of introducing a potentially dangerous gall rust of hard pines through allowing entry of Bonsai trees, the ornamental dwarfs perfected by the Japanese. Now these come in only in small numbers, hand carried by returning tourists and traveling officials, so obviously plant quarantine inspectors are on the alert. But, as much as quarantine regulations and inspection services have improved, world transportation has improved even more—both in coverage and in speed; on land, on sea, and in the air. The possibilities for foreign disease introductions are greater now than ever before. It seems reasonable to presume, therefore, that sooner or later still other foreign diseases can be expected to appear on North American shores. It can only be hoped that if their entry is unavoidable their presence will be detected early and they will be eradicated soon thereafter.

Conceding that protection through enactment and enforcement of quarantine regulations is more effective on paper than it can possibly be in practice, and that eventually there will be other leaks in the dike, preparation for that eventuality should begin now and our second line of defense strengthened. And just what is the best second line of defense? There is unanimous agreement among pathologists that everything possible must be learned about the identity and behavior of pathogens in all parts of the world now causing or potentially capable of causing disease on American trees or closely related species. Effort should first be concentrated in those countries geographically closest and climatically most similar to North America, but few countries anywhere in the world can safely be ignored. Even in such distant and tropical places as Africa, Asia, and Indonesia there are combinations of latitude and altitude that create climatic islands not too different ecologically from many places on this continent and in them are found tree species of remarkable similarity. It does not appear unreasonable to expect that these "islands" might harbor diseases that would be serious if introduced into North America. There may be a tendency to be inattentive to such areas, however, because they are so far away and offhand seem so very different.

Signs of Progress

A considerable amount of work has already been done over the years toward bolstering this essential second line of defense and activity is constantly gaining momentum. Foresters and pathologists from North America have been traveling abroad for years to observe forestry practices in general and forest disease problems in particular. These foreign travels have generally been arranged on a personal basis, however, and usually have not been part of a planned, organized, and coordinated international survey effort. Europe has been a particularly fruitful field for the detection of threatening forest tree diseases because of climatic similarities and the many plantings there, some quite old, of trees introduced right from our own back yards. Thus insight has been gained not only to the identity of organisms to be on the watch for, but the experience of others in how best to cope with them is also available. The seriousness of several forest tree diseases not uncommon today in one European country or another but not yet known in North America has already been publicized. Five of the potentially most important of these are:

An ash gall caused by *Bacterium savastanoi fraxini;*

A bacterial canker of poplar caused by *Pseudomonas rimaefaciens;*

The watermark disease of willows caused by *Bacterium salicis;*

Another mistletoe for hardwoods, especially black locust, namely, *Viscum album;* and *Peridermium pini* on hard pines.

And while *Fomes annosus* (*Trametes radiciperda*) is common property, American pathologists and foresters are now benefiting from the years of experience their European counterparts have had with this root rot—especially in plantations, thinned stands, and unnatural mixtures.

Current and Future Outlook

The picture is much brighter right now, however, because of two recent events that provide means to at least start a worldwide forest disease survey of the scope all would like to see.

The first of these is the accelerated activity of the International Union of Forest Research Organizations. IUFRO was founded in 1890; reorganized in 1929, and again in 1948. In 1956 the U. S. Forest Service formally joined the organization and the assistant chief for research was elected to the Permanent Committee, or governing body. One of the aims of IUFRO is the establishment of close personal relations between forest research workers of all countries, especially between specialists working in the same fields of activity. IUFRO works closely with the Food and Agriculture Organization of the United Nations (FAO) with the United Nations Educational, Scientific, and Cultural Organization (UNESCO), with other international organizations, and counts some 100 individuals or organizations from 34 countries among its members.

Of more direct interest to foresters and forest pathologists and to the problem under discussion, is Section 24 of the IUFRO program which encompasses Forest Protection. At the Oxford meeting in 1956, a new working group was formed to stimulate international cooperation for the establishment of test plantings of important forest tree species on several continents with regard to resistance to diseases and pests. Membership includes representatives from 10 countries: United States, Canada, Great Britain, Netherlands, Norway, Italy, Austria, Yugoslavia, India, and Japan. Efforts are also being made to bring in qualified representatives from the USSR.

Through conference and correspondence this committee has agreed upon the following program to meet its stated objectives:

1. Literature reviews and publications similar to Spaulding's[2] Handbooks 100 and 139.
2. Establishment of test plantings and inoculation trials—especially of pines, oaks, and poplars.
3. Special forest disease field surveys.
4. International plantings for determination of disease hazards and disease susceptibility.

The committee has proposed a worthy and ambitious program, a program that will obviously go far to ease the problems created by the possible spread of forest tree diseases from one continent to another—if it can be carried out. The committee members are all highly competent and most enthusiastic but all are faced with a common problem — inadequate finances.

Right here is where the second fortuitous circumstance comes into play, a circumstance that bids fair to at least partially solve some of the fiscal problems and permit at least a start being made toward implementing this needed program.

The United States Government has sold and is continuing to sell surplus agricultural commodities to many countries of the world. Payment for these commodities is accepted in currency of the recipient country. Since zlotys, rupees, rupiahs, kyats, bahts, pesos, pesetas, and the like present dollar conversion problems, the U. S. Government has accumulated a considerable local credit balance in countries where these are the monetary units. Congress has passed legislation authorizing expenditure of part of these accumulated foreign currencies by the U. S. Department of Agriculture to support research in the general field of agriculture. Under the provisions of appropriate sections of Public Law 480,[3] these funds can be used to make grants or negotiate contracts (generally for 5-year periods) with local scientific institutions to undertake research on problems of interest to the United States. Certainly problems associated with the threat of international spread of forest tree diseases are of vital concern and well within the realm of agricultural research.

Among the very first suggestions that were carried in 1958 and 1959 by departmental survey teams to Europe, the Far East, and South America, as guides to areas of research acceptable for proposals, were items on forest disease surveys and the establishment of test plantings. Firm proposals have already been received and appraised for a disease survey of conifers in the mountains of Spain and for the establishment in Poland of test plantings of forest trees of seven commercially important North American genera. The first draft of a proposal has also been submitted from Uruguay for the establishment of test plantings of selected North American pines. This proposal is now being reviewed and still others are anticipated as formal procedures guidelines become more firmly established. Additional surveys of forestry research potential in Poland, Yugoslavia, Finland, Spain, Israel, and France have recently been

[2]Spaulding, Perley. 1956. Diseases of North American forest trees planted abroad. U. S. Dept. Agric. Agricultural Handbook 100. 144 pp.

————. 1958. Diseases of foreign forest trees growing in the United States. U. S. Dept. Agric. Agricultural Handbook 139. 118 pp.

[3]Agricultural Trade Development Assistance Act of 1954 (Public Law 480, 83rd Cong., 7 U.S.C. 1704, sec. 104[k]).

made and it is known in Turkey, India, Iran, and Brazil that the United States would like to receive, for review, proposals having to do with forest disease surveys or the establishment of test plantings. Additional suggestions for similar proposals will no doubt be offered as still other countries, representative of other geographical areas of the world, become active participants in the PL 480 program.

It should not be presumed that the efforts of the IUFRO group, implemented or assisted wherever possible by PL 480 funds, will provide all the information needed or desired about the worldwide forest tree disease situation. It can be safely presumed, however, that the increased knowledge so gained will place American forestry in a far better position than now enjoyed —at least it will be better forewarned about potential threats. A truly international detective force will be looking after forestry interests.

A Final Admonition

Another section of PL 480 provides for the translation into English of research publications not now available to most American foresters because of language barriers. This alone could vastly improve total knowledge of the world forest tree disease situation and serve to keep foresters more alert to threatening situations. But neither translations, foreign literature reviews, field surveys, nor intercontinental test plantings will keep foreign diseases off North American shores. Dependence still must be placed upon quarantine regulations and inspections, and hence all must work and cooperate in every way possible with those agencies and persons assigned the enforcement responsibilities. Finally, there is strongly implied a dual responsibility—to protect North American forests and also to be positive that no individual or collective action is taken that might lead to the introduction of even one more North American forest tree disease into some other country. This is truly one situation where "share and share alike" is not the accepted philosophy.

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Ellen Condon Dowling (1905-1960)

On September 23 death came to Ellen Condon Dowling, for over thirty years editor of the Charles Lathrop Pack Forestry Foundation, Washington, D. C.

Foresters in many fields of work and in many lands will remember her not only as editor and writer but as a never failing source of helpfulness.

She came to the Foundation a girl in her twenties at a time when the recently created Pack Foundation was casting about in search of spheres of most promising usefulness. She became part of the Foundation's growth and helped shape its direction. When the Foundation embarked on world forestry she assumed much of the added labor, which to her was never work but an opportunity to contribute to the service of conservation. Regardless of the pressure of deadlines she devoted time and patient research toward the inquiries that flooded in upon her as the work of the Foundation widened.

The tropical foresters of the world held a very special place with her and she spent long hours to bring her "Tropical News Notes" to their highest usefulness.

As editor of the Pack Foundation she brought to its many publications a level of exacting standards that was maintained until the end. To equip herself for this she studied at George Washington University, specializing in botany, soils, plant pathology, and French. Honors followed. She was elected to membership in Phi Beta Kappa and to the honorary botanical fraternity, Phi Epsilon Phi. She received the coveted French Prize from among several hundred contestants. She was an honor student.

Her illustrated booklet "Gabby and the Forest Fires" ran through a number of editions in the United States and was translated into four languages.

In the early days of the United Nations Ellen Dowling went to Europe to help FAO edit and produce their first documents. She was a delegate to the Third and Fourth World Forestry Congress and illness prevented her attendance at the Fifth.

Any bare cataloging of her achievements gives only the slightest picture of the place in forestry that was uniquely hers. That place came in great part from her spirit—from her sense of unshakable belief in forestry and in planned resource use. To that was added a quality of dedicated service toward anyone who asked for help, whether a high school student considering forestry as a career or a forester in some remote outpost seeking information. To these she brought an eager willingness to help, just as to forestry itself she brought a completely selfless devotion. These qualities she had in abundance until the end. They were the very essence of her gift to forestry. She has now become part of forestry's saga; part of its professional integrity but more than that of the human spirit that gives to this profession life and meaning.

Oak Wilt in Pennsylvania

F. C. Craighead and
J. C. Nelson

THIS PAPER attempts to interpret and evaluate the results of some of the work, principally control and transmission studies of oak wilt[1] for the past seven years, 1952 through 1958, at the Blain Oak Wilt Laboratory[2] in Perry County, Pennsylvania.[3]

The results of this work were presented in mimeographed "Progress Reports" (*7, 8, 9,* and *10*) from 1952 through 1957 and by several short papers published at intervals. Admittedly certain of the concepts advanced here are still somewhat theoretical and not fully proven by experiments but they are supported by substantial circumstantial evidence. For the present these concepts seem to be the best reasoning to tie together several diverse and seemingly conflicting observations. We still do not understand important fundamentals in the life history and transmission of this fungus.

General

Distribution of oak wilt in Pennsylvania.—The oak wilt disease is generally distributed through the mountainous country of south central Pennsylvania (*17, 9, 10*), (Fig. 1), with the heaviest concentration in a wedge-shaped area extending from the southern border northward in Bedford, Fulton, Franklin, Somerset, Blair, Huntingdon, Mifflin, Juniata, Perry, and Cumberland Counties. Also there are one to five scattered isolated infections in Lawrence, Beaver, Clinton, Adams, Jefferson, Greene, Centre, Erie, Cambria, Westmoreland, and Butler Counties; in addition Allegheny, Armstrong, Clarion, and Indiana Counties have 6 to 30 infections. Many of the outlying infections that have been examined carefully are very old, notably in Erie, Perry, and Cumberland Counties.

A remarkable feature of this distribution is that the perimeter of the south central area of heavy infection has not extended in the past 7 years. Also there is no discernible pattern of spread around the known infections beyond root grafting distance. Even the most eastern isolated centers have shown no tendency to spread into nearby woodlots even though they have not successfully been brought under control.

Oak wilt in Perry County.—Perry County lies in the northeastern portion of the generally infected oak wilt zone of Pennsylvania. The distribution of the disease based on symptoms in the

THE AUTHORS are respectively consultant, Bureau of Plant Industry, Pa. Dept. Agric. (during the period of these studies) and research forester, Pa. Dept. of Forests and Waters.

[1]A disease of oak trees caused by the fungus *Ceratocystis fagacearum* (Bretz) Hunt.

[2]This field laboratory has been a cooperative undertaking among state agencies since 1952 when Perry County was set aside from the state control program for a research area. Through 1952, 1953, and 1954 the work was carried out by the Department of Forests and Waters and the Bureau of Plant Industry, Pa. Dept. Agric., Caleb L. Morris representing the former and F. C. Craighead the latter. J. C. Nelson joined the staff in 1953 and took on the responsibility for the surveys and experimental control; B. L. Hadley and Hugh Thompson assisted part time during the seasons of 1954 and 1955. In 1955, W. J. Stambaugh representing the Botany Department of the Pennsylvania State University, joined the work. Beginning in 1955, the studies were planned and carried out jointly by the three agencies.

[3]These studies were greatly facilitated through the critical interest and encouragement of J. E. Ibberson, Pa. Dept. of Forests and Waters.

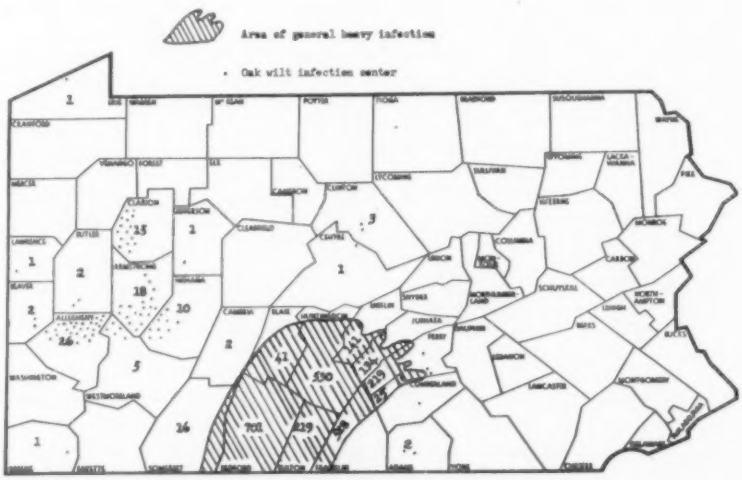

FIG. 1.—Map of Pennsylvania outlining counties and showing distribution of oak wilt based on recognizable symptoms in red, black and scarlet oaks. This area has not materially enlarged since 1952, although some old infections that were picked up later had been missed in early surveys. Note concentration in south central Pennsylvania.

red oak group is restricted to the southwestern section of the county (Fig. 2) and has not enlarged since 1952 when intensive ground and aerial surveys were initiated. Each year some previously located centers spread and some previously undetected centers are found. The number of active centers located annually has varied somewhat from year to year (Table 1). A small number of infections was located in the extremely dry summer of 1957 in spite of a great increase in the intensity of the air survey that year, and the greatest number of active centers were identified in 1956 and 1958, both very wet and relatively cool seasons. This may indicate an environmental stimulation to activity of latent fungus in non-symptomatic trees. Very few "single" infections appear in any one year.

Most known infections in Perry County occur on the ridges and upper slopes. These are predominately on rough sandstone outcrops (Tuscarora sandstone) in overmature timber that has never been logged. Three of the smaller ridges carrying numerous infections are shale (Rose Hill shale).[4] Three active centers are in farm woodlots. No centers of infections occur on limestone soil. Few centers are found in mountain valleys or in stands of Site I classification. However, three areas on Site I are under observation where the overmature red oaks (*Quercus rubra* L.) have been gradually dying for many years, leaving only white oak (*Q. alba* L.). Most centers are at least 10 years old and probably much older. In Cumberland County there is good circumstantial evidence that one center (*8*), the most southeasterly in the state, has been present at least 25 years[5] (*9*).

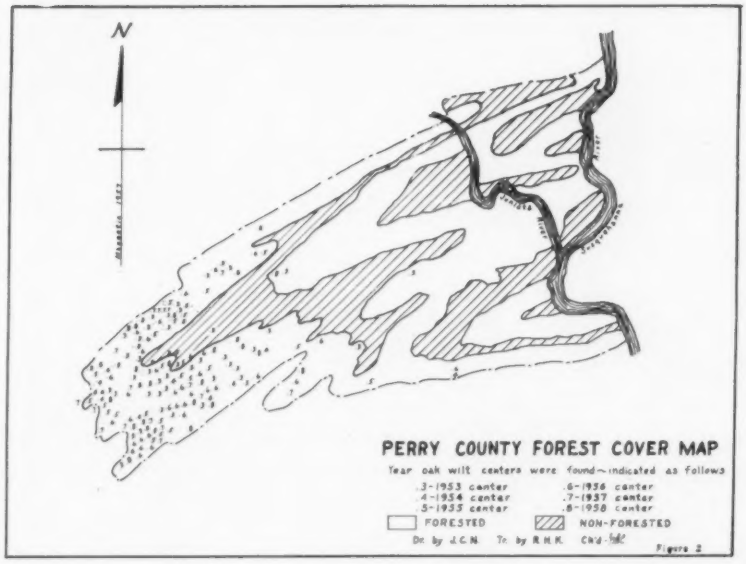

FIG. 2.—Oak wilt infections in the red oak group in Perry County. Note concentration in SW area and irregular distribution showing concentration on ridge tops. Pattern has not changed since 1952 when these studies began.

Disturbed areas.—Jeffery (*17*) has called attention to the frequent multiple infections along right-of-way clearings and in lumbering operations carried on through the spring months, particularly May. Such disturbances offer the best evidence we have for overland spread of the disease. Three pipeline rights-of-way cross the infected territory in Perry County, but it was not until 1957 that multiple infections took place along one line although pruning operations had been conducted in other years. On the Tuscarora pipeline, over a mile of pruning was carried out during the winter of 1956-1957, all of which took place prior to new growth activity. The trees were climbed with irons and overhanging branches were sawed off. On July 5, one wilting tree was observed in an advanced stage of wilt and 15 more showed early symptoms. By August 10, five more had wilted. A total of 21 of 101 pruned red, scarlet (*Quercus coccinea* Muenchh.), and black oaks (*Q. velutina Lam.*) wilted in 1957 and one chestnut oak (*Q. prinus* L.) showed symptoms. Twelve trees, 3 to 40 feet from the 1957 wilts, died in 1958 and 4 additional trees as of July 1, 1959 have wilted. This operation crossed three knolls with rather steep valleys between. Nearly all of these wilting trees were near the tops of knolls where chestnut oak abounds. No active wilt trees were known within one-half mile previous to 1957. All pruned trees had many bleeding spur wounds which were being frequented by animals.

Five logging areas have been under observation in Perry County. One was cut in 1948—the others from 1953 to 1956. The disease was found in the red oak group and occasionally in white oak and chestnut oak on all these areas. There was extreme variation in the mortality in different areas. In some, many trees wilted; in others, only one or two. The disease is still progressing in all areas at varying rates despite all efforts at control.

Atypical red, black, and scarlet oak.—It had gradually become ap-

[4]These formations were identified by Dr. Carlysle Grey, Pennsylvania State Geologist.

[5]When the senior author first saw oak wilt in a Pennsylvania center in 1952, he was immediately impressed with the similarity to the conditions encountered from 1913 to 1918 in the southern Appalachians where the extensive mortality of oaks was under investigation by the U. S. Department of Agriculture. Also, during this period, a high percentage of the red and pin oaks around the old Agriculture buildings in Washington, D. C., died. In 1932-1933 similar conditions prevailed on the campus of the Iowa State College at Ames.

TABLE 1.—ACTIVE OAK WILT CENTERS IN PERRY COUNTY LOCATED BY AIR AND GROUND SURVEYS FROM 1952 THROUGH 1958

	Total no. of active infection centers located[1]	Single infections in natural forest[2]	Infection centers found in disturbed areas	Old infection centers found because they became active[3]	Breakovers of previously located and treated centers[4]					
					1953	1954	1955	1956	1957	1958
1952	8	...	...	...	0	1	1	0	0	1
1953	31	3	...	28	...	10	14	4	3	0
1954	19	4	...	15		...	8	8	1	1
1955	35	3	4	28				12	4	5
1956	49	5	12	22				...	1	8
1957	35	2	14	19					...	10
1958	42	4	7	31						
Totals	219				0	11	23	24	9	25

[1]Infection center—one oak wilt tree or several oak wilt trees within 50 feet of each other (including dead stems or stumps of previously oak wilt killed trees). This total includes single infection centers in disturbed areas and old infection centers located for the first time but not the breakovers. On disturbed areas the same classification was followed but obviously where many wounded trees go down simultaneously on a logging area such grouping is purely arbitrary.

[2]Single or new infection centers—one infection center in which one or more living oaks are showing wilt symptoms for the first time and there are no wilt killed stems or stumps. Often there may be infected white or chestnut oaks nearby or infected species of the red oak group that do not show typical oak wilt symptoms.

[3]Old infection center—an infection center in which living oaks have not shown wilt symptoms prior to current year and wilt killed stems or stumps may be present. These constitute the largest number of infections found in the surveys. They may have been periodically active for many years.

[4]Breakover—the recurrence of oak wilt within 50 feet of a treated infection center, including isolation zone when it is part of the treatment. Breakovers of all treatments were nearly 50 percent of the total centers. Some broke over several times but only two breakovers occurred out of 96 treated by the arsenic basal frill method.

parent from observation of many natural centers that all individuals of the red oak group do not react in the same manner to the disease (*9, 10, 28*). In 1956 and continuing through 1957 and 1958, trees were inoculated in the top to determine if it were possible to consistently recognize early symptoms such as early fall coloration, retarded bud opening, dwarfing of the leaves, and gradual die-back of the top. In addition many trees showing these symptoms were numbered and have been under observation since 1953. These top inoculations into broken twigs, insect wounds, and increment hammer holes produced consistent symptoms all three years. Some trees wilted quickly but many died branch by branch and some are still showing "die-back" symptoms while others have, to all appearances, recovered completely.

Other host plants.—Most of our native oaks and some other genera including the native chestnut (*Castanea dentata* [Marsh.] Borkh.) have been shown to be susceptible to the disease or carry it in a latent form (*10, 2*). Evidence (*8, 9*) is gradually accumulating that the disease is widely prevalent in chestnut oak and white oak in Pennsylvania. These species rarely produce typical foliar symptoms and can seldom be detected by field diagnosis. They are rarely killed, but diseased individuals may show some retarded opening of the buds and dwarfed leaves year after year on some branches. No fruiting bodies have been found on such trees. However, infected limbs may serve as a source of inoculum by means of sporulation in water pockets of insect holes or other branch wounds. Most of the common insects on red oak attack these other species.

Stumps and sprouts.—The oak wilt disease in stumps may persist and cause recurrent symptoms for several years in the sprouts. Stump sprouts of red and chestnut oaks have been dying each year in a logging area that has been under observation from 1952 through 1959. In many cases the sprouts die one at a time and the death of all the sprouts on a stump may take from 5 to 10 years. These slowly dying stumps may constitute a lasting source of inoculum for both root graft and long distance transmission.

Pattern of spread.—To recapitulate, the apparent distribution of oak wilt in this area is that of scattered local centers of indeterminate age (Fig. 3), often 10 years or more, and around these dead trees one to several green trees are affected at intervals of one to 5 years (longest interval definitely established in Perry County). The currently dying trees are rarely over 30 feet, usually much less, from a dead tree. Occasionally a tree becomes infected beyond these centers. These so-called "singles" have been attributed to overland spread. Perry County "singles" have been relatively infrequent—2 to 5 per year (Table 1)—while the "breakover" around older dead trees is relatively frequent. This concept is based on the recognition of typical wilting symptoms in the red oak group. All these "singles" in Perry County are within root grafting distance of chestnut or white oak and in practically all cases American chestnut as well.

In addition there are the multiple local infections appearing in disturbed areas. Some of these trees likely carried the fungus prior to wounding. Even in the disturbed areas the infections that develop in association with these wounds are extremely local and spotty and do not extend over the entire wounded section, nor more than a few feet into the undisturbed forest.

Economic importance.—All workers agree that the oak wilt fungus is a most virulent organism. When it is introduced into the xylem of certain species of oaks it can kill the trees in a few weeks. Also the organism is capable of living without killing its host in nearly all oaks and some other

genera as well and from this latent reservoir it may be possible to infect and kill trees in the red oak group. Thus it is conceivable that the disease could be very destructive under suitable but still unknown conditions. Between 1912 and 1920 it may have been responsible for the death of many more oaks than are dying currently.

The timber destroyed in Perry County from 1952 through 1958, seven years, totals 1,616 trees; about 90,000 board feet worth $1,440 (*10*). The statewide loss based on all reported infections is approximately 1,073,000 bd. ft. worth, at current stumpage rates, about $16,000. The destruction of green trees in the control work is equivalent to more than twice these amounts.

The greatest danger and apparently the only important economic aspect of the disease at the present time is the increased mortality in areas of disturbance such as right-of-way clearings and logging operations. The excessive mortality of reserve trees on timber sales is a matter of very serious concern in managing these oak forests.

FIG. 3.—An old oak wilt center near Blain, Pa., August 1959. In 1951 there were many dead trees in this infection spot indicating previous mortality. Each year since 1951 one or more trees have died on the perimeter of the center.

Photo by D. S. Nace.

Transmission of Oak Wilt

In Pennsylvania and several other states much experimental work has been directed toward explaining the apparent spread of oak wilt. A number of animals have been reported capable of transmitting the disease. In the early studies when the virulence of the disease in the red oak group first became apparent, but before the distribution of the fungus was well kown, it was justifiable to think of the disease as a rapidly spreading threat to our oaks. Now that its natural range is fairly well defined and it is found to occur commonly in several host plants, the present problem appears to be that of explaining the sudden wilting of an occasional red, black, or scarlet oak.

Source of inoculum.—Three sources of inoculum have been considered in these studies: mats, root-grafts and bleeding wounds.

The fruiting bodies or mycelial mats have been recognized as a source of inoculum since 1952 (*11*). They are especially attractive to a large variety of insects as well as other animals. There can be little doubt that the spores picked up by visitors to mats are carried to receptive wounds and infect healthy trees (*15*). However, all evidence developed in our transmission studies and on the inoculation plots suggests that this does not occur very frequently in nature. On certain distubed areas multiple infections occur when few mats are known to be in the vicinity. From 1952 through 1957, groups of 12 to 200 trees were inoculated to study local spread. The sites were selected as far as possible from any known natural infections. To date only two trees—these were wounded—have died beyond the immediate perimeter of these inoculation plots although over 150 trees have wilted within the plots. These were rarely beyond 30 feet of those inoculated. Hundreds of mats were present on these plots. If insects and mats are of prime necessity for overland transmission, then a definite pattern of spread should have developed around such concentrated sources of inoculum. In some states the disease is reported to be spreading where either no mats are present or they are rarely observed (*19*).

Root-grafts have been advanced as responsible for much local

spread (*18, 20*), and much circumstantial evidence supports this. We have attempted to demonstrate the presence of root-grafts on all trees dying within our study plots and many natural infection centers. This has been difficult because of the rocky nature of the terrain, but some 20 percent of the wilting trees have been found grafted and this may be much higher. Many grafts are not functional. The distance between the wilting trees in Perry County and the nearest old wilts is not over 30 feet in 90 percent of the cases (*23*). The importance and function of root-grafts in the transmission of this disease is still not clear.

For some time it has been suspected that other sources of inoculum, in addition to mats, were available in order to explain the many infections in disturbed areas, such as logging operations and right-of-way clearings. Recently it has been demonstrated that pockets or holes that penetrate the xylem of infected trees may become reservoirs for inoculum during humid weather when such injuries hold water (*10, 29*). This has been established for inoculated trees before wilting develops, initially wilting trees and those in full wilt. The solution from wounds on these trees when used as an inoculum into fresh wounds on healthy trees produced the disease (Fig. 5). This has far-reaching implications in explaining transmission of the disease and failure of local control methods. Stumps, many of which exude for weeks, may produce inoculum. Axe cuts, insect holes, broken stubs of branches or lightning scars provide cavities that fill with water and many carry inoculum. Much of the inoculum on wood boring insects may be obtained in their pupal cells. It is the habit of adult borers to cut an exit hole from the pupal cell and remain in this open wound several days, during inclement weather, before emerging.

Susceptibility and characteristics of wounds.—The importance of wounds for host invasion by the oak wilt fungus has been shown (*15, 6*). The fact that only a few of the wounds are receptive among the many that occur on all trees is obvious. This rare susceptibility has been variously explained by several investigators. Age of wound (*8, 32*), timing of the wound during spring wood formation (*5, 16, 25*), water retention in the wounds as a necessity for animal attraction (*6, 7*), spore germination and spore convoy into the vessels of the xylem, particularly that of the current spring wood (*10*), and the reopening of wounds blocked by tyloses by insects or other animals (*10*) (Fig. 4), have been suggested (*4, 7*). Possibly a combination of some of these factors must be present. There is still much to be learned about the receptiveness of the wound and the exact means by which the fungus gains entrance into the vascular system of the host. For several years all the wounds on naturally wilting trees were examined and classified in so far as possible as to age, type and origin. This study pointed out the great number and variety of wounds on all trees (*9*) but did not show any particular type of wound consistently associated with dying trees.

Fresh wounds are usually immediately attractive to insects, but may lose this attractiveness the second day (*10*). Later they may begin to bleed copiously and continue for many weeks during which time they are again attractive to insects and other animals. Contamination by bacteria and yeasts may stimulate the bleeding. Tyloses formation develops in a few days and this may prevent infection (*10*) until the wounds are enlarged by insects, mammals, and birds, thus bringing the inoculum into contact with the current ring. This bleeding fluctuates with the turgidity of the tree—it is greater at night and during rainy periods. Also those wounds penetrating the heartwood draw on the reserve of moisture in this cylinder and bleed copiously over several weeks or months. Mechanical sti-

FIG. 4.—Wound made by the pileated woodpecker removing a carpenter worm. Such wounds probably serve as infection courts.

Photo by A. T. Drooz.

FIG. 5.—Aluminum cup cemented to opening of borer gallery to catch exudation for use as an inoculum into living trees.

Photo by A. T. Drooz.

mulation resulting from activity of wood borer larvae in living trees promotes exudation for two or three years. It is highly probable that the exudates from these wounds on healthy trees may serve as a suitable culture medium and reservoir for the fungus.

Vector relationships.—Many insects and other animals have been under observation in an effort to find some vector that plays a reasonably consistent role in transmitting the disease. Many insects and other arthropods carry inoculum as they move about in the vicinity of diseased trees and most of these theoretically could transmit the diseaese. These possibilities were emphasized in the oak wilt studies and have been extensively explored: (1) A direct vector carrying the inoculum from a diseased tree into a portal it makes in a healthy tree. (2) The transfer of inoculum from mat to wound (*6* to *10*, *15*, *30*).

It has not been possible to satisfactorily demonstrate any direct vector from diseased trees to healthy trees in the sense that *Scolytus multistriatus* (Marsh.) transmits the Dutch elm disease fungus. Caged contaminated insects that emerged from diseased trees failed to transmit the disease in their normal attacks on healthy trees (*6* to *10*). Such tests were made with scolytids, several species of ambrosia beetles, and two species of *Pseudopityophthorus*, oak bark beetles; *Agrilus bilineatus* (Web.), the two-lined chestnut borer, one of several suspect buprestids; and with *Arrhenodes minuta* (Drury), the oak timber worm.

Several hundred cages were set up in which either the sporulating mat with all its fauna, or in some cases single species of contaminated insects, were transferred to fresh wounds on healthy trees. Very few positive results were obtained until May 1956, when the contaminated insects were placed in increment hammer wounds penetrating several growth rings. Nine out of 14 trees wilted. However, this is a highly artificial technique and these results could not be repeated on nearby trees in June or August of the same year (*10*).

Several cases of transmission have been reported (*3*, *12*, *25*, *30*). Most of these experiments also were conducted under rather artificial conditions, and the writers have never felt that they explain any persistent natural phenomena. Nevertheless, we cannot exclude the rare occurrence of such transmission, at least until the behavior of the fungus within the tree and the receptivity of wounds are better understood.

It now seems that overland spread of the disease, to fit the observed facts in Pennsylvania, must be overwhelmingly from wound to wound. To determine the animals that were frequenting these bleeding wounds, in April

FIG. 6.—Cross section of a living infected limb from a chestnut oak; note discoloration and tyloses in older rings. The only symptoms produced on this tree were slightly smaller leaves and delayed opening of buds on the infected limb. Such limbs are commonly attacked by insects, chiefly *Agrilus*, the two-lined chestnut borer. This borer and woodpeckers removing the larvae bring the fungus into contact with the current annual ring and hasten wilting.

Photo by A. T. Drooz.

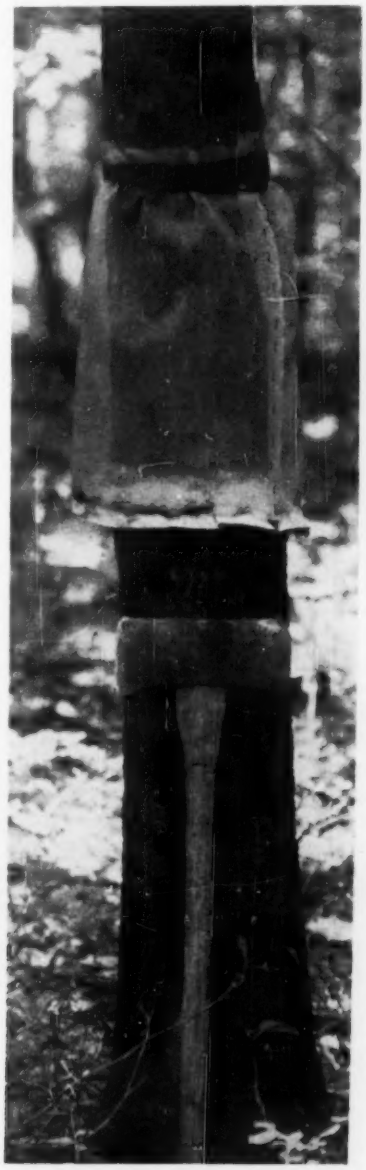

FIG. 7.—Trap placed on diseased trees and wounded healthy trees to collect insect visitors. Many insects carrying oak wilt inoculum were trapped on both infected and healthy trees.

Photo by A. T. Drooz.

1958 a series of traps (Fig. 7) were placed on the boles of mat bearing trees in one of our inoculation plots and on a series of wounded trees about 100 yards distant. Insects and other animals were collected from these cages every few days throughout the season. Many of the same species of animals were trapped on both healthy and wilted trees. Many were very abundant, especially some forms heretofore given little consideration as agents in the dissemination of the oak wilt fungus. Quite a few of these are species that do not fly but their activities would well adapt them to function in local spread. Many are nocturnal. The oak wilt fungus was recovered from some of the animals on both diseased trees and on the wounds of healthy trees 100 yards away. Table 2 lists some of the forms that are considered most important and indicates those from which the inoculum was recovered. Undoubtedly many more animal species carry spores than those found positive in this test.[6]

The intimate and frequent contact of these animals with the bleeding wounds on diseased and healthy trees gives ample opportunity for the transfer of inoculum from infected water pockets to those on healthy trees. Many of the flies actually breed in these wet wounds. Several species of lepidopterous defoliators that fell from the leaves and crawled back up the trunk, and several noctuid larvae that feed in the outer bark and/or leaf mould were observed feeding on the wound exudate or actually crawling into the wound. The sapwood borers, buprestids and cerambycids, are attracted to the dying trees in great numbers and drink the exudate from wounds. Ants are always abundant around these wounds, feeding on other insects as well as on the exudates. Predacious insects such as the large carabid, *Calosoma*, are frequent visitors to bleeding wounds. These beetles moved up and down the trees continuously during the trapping period, plucking insects from the wounds. The New York weevil, *Ithycerus*, was a common wound feeder through May, June and July. It also feeds on the bark of young twigs. Another insect persistently feeding on the wound exudates was the nocturnal wood cricket, *Atlanticus* spp. It was common from April through August. Millepedes were abundant, crawling from wound to wound, and when the wound was of sufficient size they often spent the day curled up in the cavity. Harvestmen and other arachnids visit these wet areas, and most of the sap-feeding beetles frequently found on mats were equally abundant in these wounds. Deer mice, *Peromyscus* spp., frequented the cages and ate many of the trapped insects. Several species of birds were observed picking insects from the wounds.

The pileated woodpecker, *Ceophloeus pileatus* L., is a bird largely restricted to areas of old defective timber, where incidentally oak wilt is most abundant. It may play an important role in making wounds that serve as reservoirs for wound exudates and in activating the fungus from deeper layers of wood to the current annual ring on non-symptomatic trees. It frequents bleeding wounds and many diseased trees in Perry County show the characteristic work of this bird in removing ants and borers (Fig. 4).

Thus systematic observation of the bleeding wounds revealed them to be an attraction and a gathering point for many insects and other animals heretofore given little consideration in transmission studies. This wound-to-wound relationship seems to be the most simple and satisfactory explanation for a large part of both local and overland spread of the oak wilt fungus. Wounds into the xylem fill with liquid during rainy weather or

TABLE 2.—ANIMALS FREQUENTING BOTH MATS AND WOUNDS ON DISEASED TREES AND BLEEDING WOUNDS ON HEALTHY TREES

O—animal not capable of flight
+—animal found carrying oak wilt inoculum
?—animal not tested for oak wilt spores, but very abundant

Molluses—slugs (not determined)	O, ?
Birds—woodpeckers, creepers, nuthatchers	?
Mammals—grey squirrels, chipmunks, and deer mice	O, ?
Millipede—*Spirobolus marginatus* Say	+
Arachnids—Harvestmen and spiders	O, ?
Insects:	
Collembola—several undetermined species	O, +
Coleoptera—Most of the mat-frequenting species, also:	+
Strongylium spp.	?
Mercantha contracta Beauv.	?
Helops spp.	?
Calosoma frigidum Kirby	O, ?
Cerambycidae, five species that breed in the sapwood of diseased trees; also *Leptura nitens* Forster and *Pseudostrangalia cruentata* (Hald.)	+ ?
Ithycerus novaboracensis (Forst.)	+
Cossonus corticola Say	+
Arrhenodes minuta (Drury)	+
Three species of ambrosia beetles previously reported	+
Lepidoptera	
Geometrid larvae, defoliators	+
Gelechiid larvae, defoliators	?
Cossid larvae, wood borers	?
Noctuid larvae, bast borer	+
Diptera	
Eleven[7] species of flies many of which frequent mats and three of which were reared from the exudate in the wounds, namely *Solva pallipes* (Loew), *Ferdinandea dires* (O. S.), and one undertermined	+
Hymenoptera	
Camponotus 2 spp.	+
Periclista inaequidens (Nort.) sawfly larvae dropping from the foliage	+, O
Orthoptera	
Atlanticus spp. This is a very common forest species of cricket that is a constant frequenter of the bleeding wounds	+

[6]Dr. W. J. Stambaugh cultured most of these forms and some were tested by W. L. Yount, but the limited facilities for this work greatly restricted its scope. There is need for greatly extending this phase of the studies. A complete list of these forms may be reported later. Most of the insect determinations were made by the Insect Identification and Parasite Introduction Research Laboratory, Agricultural Research Service, Beltsville, Md.

[7]These will be listed in a later paper.

other periods of plant turgidity. This exudation from diseased trees contains oak wilt inoculum. It is picked up and transported to wounds on healthy trees, where, depending on the receptivity of the wound, the tree may become infected immediately or the organism may remain viable in these pockets for a time until a borer, woodpecker or breakage opens the wound to the active xylem unobstructed by tyloses. The most probable time for this to happen is during spring wood formation.

Wound-making insects.—Several species of moths and beetles bore into the wood of living trees. They maintain external openings to their galleries which hold moisture, bleed, and attract other insects, particularly flies and sap-feeding beetles. These openings are enlarged from year to year as the borers increase in size and feed on the scar tissue at the surface. Many of these wounds may at certain times actually serve as reservoirs for inoculum and also provide portals for the entrance of the oak wilt fungus. These insects, discussed in the "Pennsylvania Progress Reports" (*5* to *10*), are *Goes debilis* Lec., *G. oculatus* (Lec.), *Cossus* spp., *Prionoxystus robiniae* (Peck), *Strongylium* spp., and *Pseudostrangalia cruentata* (Hald.). The latter two species bore into the stubs of broken branches forming reservoirs that are constantly attended by sap-feeding insects. All these borers are common in the overmature timber of the ridge tops. Scarcely a storm-broken tree can be found on the ridge tops of Perry County that does not have one or more stubs infested with *Strongylium*. In addition two forms, *Leptura nitens* Forster and *Helops* spp., which feed in the living bast tissue at the root collar and crotches, occasionally burrow into the xylem.

Root borers.—A large borer, *Prionus imbricornis* (L.), mines in living roots and burrows through the soil from tree to tree, (*8*, *9*, *10*). This form is very common in Perry County. The remains of about a hundred of these beetles were removed from the stomachs of six foxes trapped on August 5, 1958, by a game warden on one of the ridges where oak wilt was frequent. The feeding tunnels of these larvae were frequent on excavated roots. No larvae were cultured for the presence of the fungus.

The two-lined chestnut borer.—Much effort was directed toward demonstrating that the two-lined chestnut borer, *Agrilus bilineatus*, can be a direct vector of the oak wilt fungus when the contaminated beetles feed on the leaves and twigs of healthy trees. The constant and intimate association with the dying trees of all species of oak and native chestnut, particularly its role in hastening the death of infected trees and branches, warrants continued observation of this species. Infected oaks, slowly dying from the top, are invariably attacked by this borer and it is difficult to determine whether the destruction of the bast tissue by the larval mines or stoppage of conduction by the oak wilt fungus is responsible for the death of the branches. The larva occasionally mines below the cambium into one or two deeper annual rings, and may bring the fungus into the current growth ring (Fig. 6).

A number of vector relationships have been discussed in the belief that not one but several of them may be functioning in the transmission of the fungus. However none of the Blain studies developed satisfactory proof for any of the theories tested. It was not possible to establish conditions that produced consistent results or closely approximated the natural mortality nearby. From 1952 through 1958, over 500 trees were wounded. Several thousand wounds of various kinds were made but only nine infections resulted. On the other hand, along one right-of-way pruning, 25 percent of the wounded trees died of oak wilt that season. It appears that either some unusual vector activity was overlooked, or information on the life history of the fungus needed for interpretation of the vector role has been lacking.

Survey and Control

The basis for the Pennsylvania control program for oak wilt is that the disease is restricted to three species of the red oak group (*17*). Surveys to locate wilting trees are carried out by aerial reconnaissance. The control technique is based on two premises; first, that the disease is spread by means of spores produced on fruiting bodies or mats being carried to a wound on a living tree by some animal agency; second, by the fungus passing through root grafts between diseased and nearby healthy trees. The destruction of the infected trees by timely felling which prevents much mat formation and the killing of the roots by the application of ammonium sulfamate (Ammate) to the stump should prevent spread (*22*).

The control program was initiated in 1952 on the basis of the knowledge available at that time. It has not been substantially modified since, notwithstanding subsequent technical developments.

The present control method may be ineffective because:

1. Ammate is not toxic to the fungus (*14*).

2. Ammate is not very effective in killing roots unless it is applied before the tree develops 50 percent wilt, and to a fairly level stump surface which has been surrounded by a collar to hold it until absorbed.

3. The treatment, by felling diseased and healthy trees, wounds many green trees and creates pockets that provide water-holding cavities on diseased trees. These pockets may produce inoculum that can be carried by animals and introduced into wounds on healthy trees.

4. Aerial surveys alone are inadequate in detecting diseased trees. Eleven aerial surveys of the heavily infected areas of Perry County in 1957 located 30 percent of the wilting trees. Some of the reasons for this failure are:

a. Trees that die over winter and do not foliate in the spring cannot be seen. In 1956 these con-

stituted 12 percent of the wilts found that season in Perry County.

b. Suppressed, intermediate trees, and stump sprouts are not seen from the air although they may have typical foliar symptoms.

c. Trees that shed green foliage are not found.

d. Infected trees of the white oak group that do not produce normal wilting symptoms are overlooked.

e. Trees that wilt rapidly and completely shed their leaves between air surveys are not found.

f. Late frosts, heavy cicada damage, and insect defoliations obscure the wilt symptoms in some areas each year.

5. The disease in chestnut oak and white oak is not recognized. These trees are ignored in the scouting and are not treated in the control work. They may represent a larger number of infections than those in the red oak group.

6. The Licking Creek Valley, an area of about 14,000 acres in Juniata and Mifflin Counties, has been under the statewide control program since 1952. A careful 6 percent ground survey was conducted in the fall of 1958, because of excessive reserve tree mortality in a cutover area (*24*). The survey revealed that only 14 percent of the infections had been found and treated during the 7 years of aerial survey and control work. The disease is still present and active after several years' efforts to eradicate the fungus in the three most eastern infections found in Pennsylvania, two in Adams and one in Cumberland Counties. These are in woodlots some 20 miles east of the heavy zone of infection.

In Perry County where constantly improving control methods were applied and 3 to 11 aerial surveys with supplemental ground surveys were used, the incidence of the disease has not been materially altered over the past seven years (Table 1). The number of singles and new infections continued about the same, and the disease frequently flared up on disturbed areas.

A variety of control techniques have been tested on the experimental control program in Perry County (*23*). Over 219 natural infection centers and 347 inoculated trees have been treated. The arsenic basal frill method has shown the greatest possibilities for effectively meeting present requirements. This method consists of applying a concentrated solution of sodium aresnite in a continuous frill cut as close to the ground as possible. The tree is left standing. No sprouting has occurred on diseased or healthy trees so treated. The roots are more completely destroyed than through any other method tested. Most insect feeding, except ambrosia beetle attack, is prevented and very few mats are produced on these trees. The wounding of green trees is avoided and few pockets capable of developing inoculum are provided. The method has been criticized because arsenic is dangerous to handle and because of past occasional death of livestock from eating lead arsenate sprayed foliage.. Sodium arsenite is now widely used in the chemical debarking of pulpwood and few accidents to man or animals have been reported (*31*).

Recommendations

After seven years' experience in research, surveys, and control of the oak wilt disease in Pennsylvania, there are still many aspects of the life history and transmission of this disease that are not understood. Our surveys are inadequate in detecting the disease and the control is not effective. On the basis of present information we should reconsider our 1952 approach to the problem. We need:

1. More effort placed on research to more fully understand the behavior of the fungus in the tree and how it moves or is carried from diseased to healthy trees.

2. An intensive survey of selected areas to determine more accurately the number of infection centers in the species of the red oak group and the prevalence of the disease in other hosts, particularly white and chestnut oaks which are rarely killed.

3. An ecological survey to determine why the disease is restricted, as we now know it, to southwestern Pennsylvania and why its range has not extended in the past seven years.

Summary

Present evidence based on the typical wilting symptoms in red, scarlet, and black oaks indicates that oak wilt in Pennsylvania is an endemic disease generally distributed in the mountains of the south central portion of the state and of more scattered occurrence in some outlying counties. Each year some of the so-called "centers" become active as evidenced by the death of a few surrounding trees and each year a few so-called "single" infections appear. The perimeter of this south central area, that has been studied most intensively, has not extended during the seven-year period of observation. The combined air and ground surveys in Perry County have located 219 active centers during the past seven years which probably represent only a fraction of the latent infections. The exception to this endemic and relatively static situation occurs in areas of multiple wounds such as logging operations and right-of-way clearings. The most serious aspect of the disease is the mortality it causes among residual trees after logging operations.

The disease is normally recognized in red, black, and scarlet oaks by the wilting of the foliage over the entire tree. However, the disease occurs commonly in white and chestnut oaks, where it does not produce practicably recognizable foliar symptoms. The number of infected trees in these species may be much greater than among those species that show "typical" symptoms. This condition is disregarded in present survey and control practices. American chestnut sprouts also may be harboring the disease.

The timber killed by this disease over the past seven years is of little consequence, approximately 1,073,000 board feet with a stumpage value of $16,000. Far more oak is

killed by "oak dieback," a term used for a widespread mortality that is little understood. More lightning struck trees have been observed in the Perry County surveys than oak wilt infections. Nevertheless, approximately $50,000 to $60,000 is spent each year on oak wilt control in Pennsylvania.

It is presently accepted on the basis of much circumstantial evidence that the disease spreads locally on the perimeter of centers primarily through root-grafts; also that overland transmission of the disease takes place by animals carrying the spores from fruiting bodies on dying trees to wounds on healthy trees. Recently it has been demonstrated that a third means of transmission may be operating, i.e., the transfer of the inoculum from wound exudates on diseased trees to wounds on healthy trees. This may be the most important means of spread and might explain the increase in wilting trees during wet seasons.

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Expression of Interest in Reprinting Book Sought

The Smithsonian Institution has been asked to consider reprinting Standley's *Trees and Shrubs of Mexico* (Contr. U. S. Nat. Herb., vol. 23, pts. 1-5, pp. 1-1721, 1920-1926), which has been out of print for years.

The Institution would welcome expressions of interest in such a reprint, the cost of which would be approximately $20.

Address inquiries to Editorial and Publications Division, Smithsonian Institution, Washington 25, D. C.

The Advantages of Using Ethylene Glycol[1] in Seasonal Storage Precipitation Gages and A Method for Computing the Initial Charge

W. J. Kidd, Jr.

SEVERAL research centers of the Intermountain Forest and Range Experiment Station maintain and operate modified standpipe-type[2] precipitation storage gages throughout the year. The chief purpose of these gages is to catch and accumulate winter precipitation, most of which is snow, during the months when travel to remote gage sites by wheeled vehicles is impossible. Recording rain gages are operated during the summer months at these remote sites so that yearlong precipitation records are maintained.

The chief problems in obtaining accurate catch data on winter precipitation are those of catching and melting the falling snow, accumulating the snow water as an unfrozen solution in the gage, and preventing evaporation of this solution from the gage.

The U. S. Weather Bureau, in its instruction manual entitled *Operation and Maintenance of Storage Precipitation Gages*,[3] recommends the use of an aqueous solution of calcium chloride to melt snow and hold precipitation in a liquid state. Such a solution was used at the Boise Research Center in 1955. However, in the fall of 1956 it was decided that an antifreeze solution of ethylene glycol would be used to charge the snow gages. The advantages for using an ethylene glycol solution are apparent from the following comparison of Prestone (a commercial antifreeze preparation) and a calcium chloride solution.

Comparison of Antifreeze Solutions

Calcium Chloride

Advantage.—The dry flake form of calcium chloride sells for 5 to 7 cents per pound. Thus, a gallon of normal antifreeze solution costs about 30 cents and is very economical. However, adding the labor cost of mixing the solution would shrink the spread in cost between Prestone and the calcium chloride solution.

Disadvantages.—Dry calcium chloride is hygroscopic and must be kept in airtight containers until mixed with water. Great care must be taken to mix the chemical and water in the proper proportions as a change of ±4 percent in the quantity of calcium chloride used in the initial charge changes the freezing point of the solution from a minimum of −60° F. to +5° F. In addition, such a mixture will, at −10° F., form a precipitate that is difficult to redissolve. This precipitate may harden and cause permanent blocking of the drain valve on the storage gage. Calcium chloride solution reacts with and corrodes bare metals such as brass or iron. The concentrated solution does not diffuse readily throughout the precipitation caught in the gage, but remains near the bottom of the standpipe during the winter. Thus the top layers of precipitation and heavily diluted solution may freeze solid during a period of below normal temperatures. The required volume of the initial charge of calcium chloride solution is about four times that of Prestone.

Ethylene Glycol (Prestone)

Advantages.—Commercial ethylene glycol (Prestone) is a prepared antifreeze solution requiring no further mixing. It forms no precipitates in cold weather. The solution does not corrode bare metal surfaces, but rather coats them with a protective film. Observation has shown that Prestone diffuses slowly throughout the layer of precipitation. Dilution by precipitation causes first a lowering of the freezing point of the solution, followed by a much slower rise than that of calcium chloride solution (Fig. 1); hence top freezing of the Prestone solution seldom occurs.[4]

Disadvantage.—Commercial ethylene glycol preparations have a relatively high cost (approximately $2 per gallon) when compared with the cost of calcium chloride.

Determining Initial Charge Required

First, from local weather data obtain:

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[1]Sold under various trade names, one of which is Prestone. Use of this and other brand names in this article does not constitute official endorsement of these products by the U. S. Forest Service.

[2]Vertical 12-inch diameter steel pipe with attached section in the shape of a truncated cone at top. The catch ring at top of cone is 8 inches in diameter.

[3]Published by U. S. Department of Commerce, Weather Bureau, Washington, D. C. 1951.

[4]This is true of the regular 12-inch base diameter standpipe, painted black. Freezing over of the diluted solution has occurred in standard 8-inch U.S.W.B. cans, unpainted.

1. Minimum temperature expected for each winter month, i.e., lowest recorded temperature for each month over the past 10 to 20 years at the weather station nearest the vicinity of the snow gage site.

2. Normal and/or maximum precipitation figures (inches) for each winter month.

Next, determine the accumulated amount of precipitation in inches expected from the time the initial charge is placed to the date of the minimum temperature expected (see Example). For reasons of economy it may be best to use *normal* monthly precipitation figures in step (2) above; or for economy plus a safety margin use Normal+maximum ppt. $\div 2$ for monthly precipitation figures in determining the amount of Prestone to use.

Finally, from Table 1, opposite total expected precipitation and under minimum temperature expected, read number of quarts of Prestone needed for each month's combination of minimum temperature and accumulated precipitation. The required initial charge is then the largest number of quarts needed for any one month.

Pure Prestone freezes at −9° F. The addition of 1 quart of water to each 4 gallons of Prestone will lower the freezing point of the mixture to −25° F. This should prevent ice formation until further dilution by precipitation lowers the freezing point of the solution below the expected minimum of the first few winter months. To prevent evaporation of precipitation from the storage gage a known quantity of oil is added to the initial charge. SAE 10 motor oil serves very well; a half-pint provides a coating about 0.12 inch thick on top of the initial charge. A much better type of oil to use, if available, is "transformer oil,"[5] which has a pour point of −65° F. and does not deteriorate as readily as SAE 10 oil under extreme con-

[5]A commercial oil obtainable from the Shell Oil Company.

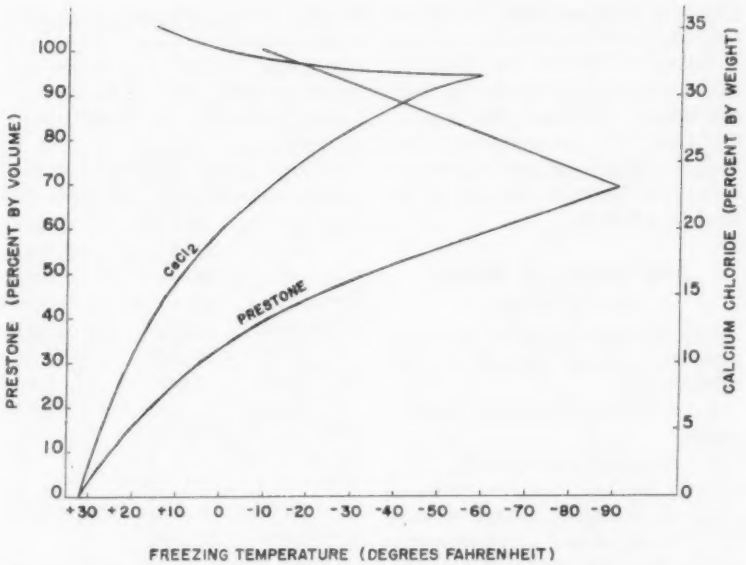

FIG. 1.—Freezing points of aqueous Prestone and calcium chloride solutions. The Prestone curve is through the courtesy of the National Carbon Company. The calcium chloride curve is from the *Chemical Engineers' Handbook*, 3rd ed., 1950. McGraw-Hill, Fig. 30, p. 1694.

EXAMPLE: COMPUTATION OF INITIAL CHARGE

	Date	Min. temp. expected during month	Accum. inches ppt. since initial charge	Quarts Prestone needed
		Degrees F.	*"Normal" ppt.*	*Number*
Initial charge	Oct. 31	+ 3	0	0
	Nov. 30	−27	6.5	5.0
	Dec. 31	−36	19.0	17.0
	Jan. 31	−42	25.0	24.0
	Feb. 28	−38	29.0	*28.5*
	Mar. 31	−28	31.5	24.0
	Apr. 30	−17	33.5	22.0
	May 31	+15	37.0	8.5

The initial charge for weather conditions shown by these data should be 28.5 quarts of Prestone (using −40° F. and 30 inches precipitation).

TABLE 1.—INITIAL CHARGE OF ETHYLENE GLYCOL[1] IN SEASONAL STORAGE PRECIPITATION GAGES

Total ppt. expected	Temperature in F.° (minimum expected)												
	10°	5°	0°	−5°	−10°	−15°	−20°	−25°	−30°	−35°	−40°	−45°	−50°
Inches													
5	1.5	2.0	2.0	2.5	3.0	3.0	3.5	4.0	4.0	4.5	4.5	5.0	5.5
10	3.0	3.5	4.0	5.0	5.5	6.5	7.0	7.5	8.0	9.0	9.5	10.0	11.0
15	4.0	5.0	6.5	7.5	8.5	9.5	10.0	11.0	12.0	13.5	14.0	15.5	16.5
20	6.0	7.0	8.5	10.0	11.0	12.5	14.0	15.0	16.0	18.0	19.0	20.5	22.0
25	7.0	9.0	10.5	12.0	14.0	16.0	17.0	18.5	20.5	22.0	23.5	25.5	27.5
30	8.5	10.5	13.0	14.5	16.5	19.0	20.5	22.0	24.0	26.5	28.5	30.5	33.0
35	10.0	12.5	15.0	17.0	19.5	22.0	24.0	26.0	28.0	31.0	33.0	36.5	39.0
40	11.5	14.0	17.0	19.5	22.0	25.0	27.5	29.5	32.0	35.5	37.5	41.0	44.0
45	13.0	16.0	19.5	22.0	25.0	28.5	30.5	33.5	37.0	40.0	42.5	46.0	50.0
50	14.5	18.0	21.5	24.5	28.0	31.5	34.0	38.0	41.0	44.5	47.0	51.0	55.5

[1]Prestone or comparable brands.

ditions of heat and cold. Hamilton and Andrews[6] recommend a layer of oil only 0.02-0.03 inch thick as an evaporation retardant. In their conclusions they state that a layer 0.15 inch thick in a gage without a funnel (similar to our standpipe type) will prevent evaporation almost indefinitely.

Measurement of Winter Precipitation

The amount of winter precipitation may be calculated by two methods:

1. Dipstick or volume measurement.
2. Weight measurement.

Both methods require measurement of the initial charge of antifreeze solution and a measurement of the final volume in the spring. The difference is the amount of winter precipitation.

The dipstick should be a thin, stiff rod accurately graduated in inches. When using the dipstick, care must be exercised to keep it vertical and to avoid placing it in the drain hole. The computed difference in depth between the reading for the initial charge and final spring reading multiplied by the conversion factor *2.13*[7] yields the equivalent number of inches of precipitation on a standard 8-inch rain gage circle.

The weight method requires weighing the initial charge, and weighing the final charge in the spring. The difference in weight is the amount of winter precipitation. The weight difference in ounces divided by the conversion factor *29.05* gives the actual inches of winter precipitation.

It is generally accepted that the weight measurement method is the more accurate, and that the weighout volume is usually greater than that indicated by the dipstick measurement. However, at this center, discrepancies between the weighout volume and that indicated by the dipstick measurement have been no greater than 2½ percent, and are considerably less than that at the initial weigh-in. The dipstick method, therefore, serves as an excellent check on the weight measurement method.

Total winter precipitation may be approximated monthly by prorating it, percentagewise, from data taken at the nearest yearlong weather station.

Snow survey data[8] [9] indicate that wind during snowstorms may cause a 15 to 30 percent loss in snow catch by seasonal storage gage despite the fact that such gages have Alter-type windshields attached. Other reports reveal that heavy wet snow may "cap-over" the 8-inch orifice and sometimes "cap-over" the entire windshield and orifice. This phenomenon often reduces the total amount of snow caught inside the standpipe and leads to errors in precipitation records. However, deficiencies caused by capping are usually not as serious as those caused by wind.[10]

If possible, monthly checks should be made on snow depth and water content of the snow at the gage sites, and a comparison made with the gage catch. If a snow "cap" is present, it should be cut away except for an 8-inch core, which should be pushed carefully into the standpipe and mixed with the antifreeze solution. This will provide a better estimate of total precipitation than would be obtained if the "cap" were ignored. Although snow measurements are occasionally inaccurate because of drifting or capping, they still produce data of considerable usefulness.

Summary

An ethylene glycol preparation such as Prestone, despite a relatively high initial cost, possesses many advantages which make it superior to a calcium chloride solution as the antifreeze in seasonal storage precipitation gages.

The method for determining the quantity of Prestone required in the initial charge is based on the monthly minimum expected temperatures, the accumulated precipitation expected, and the freezing point curve for aqueous Prestone solutions.

The amount of winter precipitation can be measured by two methods: the volume method, in which a dipstick is used to measure differences in depth; and the weight method, which translates the difference in weight between the initial charge and final charge into inches of precipitation. The weight method is the more accurate, but the dipstick-volume method serves as a good check.

[6] Hamilton, E. L. and L. A. Andrews. Control of evaporation from rain gages by oil. Bul. Amer. Met. Soc. 34(5):202-204. 1953.

[7] The U. S. Weather Bureau standard conversion factor. The true conversion factor to use depends upon the exact *inside* diameter measurements of the 12-inch and 8-inch sections of the storage gage.

[8] Personal communication with Morlan Nelson, Snow Survey Supervisor, S.C.S., Boise, Idaho, on November 26, 1958.

[9] Corps of Engineers, U. S. Army. Snow hydrology: summary report of the snow investigations. pp. 64 67. 1956.

[10] *Ibid.*

Seed Production and Dissemination by Virginia Pine[1]

Edward I. Sucoff
and Thomas W. Church, Jr.

THE SEEDING HABITS of Virginia pine (*Pinus virginiana,* Mill.) have been studied since 1950 on the Beltsville Experimental Forest in central Maryland, and on two forest stands in Springfield, W. Va. These studies have encompassed production and dissemination of Virginia pine seed under different cutting systems, annual variations in seedfall, variations in seed production among trees, and time of seedfall. The results of this work are summarized here.

Cutting Systems

Three systems of cutting pure Virginia pine and Virginia pine-hardwood stands are being tested on the Beltsville Experimental Forest. These systems are: strip-cuttings, in which 2- and 3-chain cut strips are alternated with 1-chain uncut strips; patch-cuttings, in which ⅓-acre patches are clear-cut in the middle of a stand; and seed-tree cuttings, in which 5 to 40 trees per acre are left standing after logging. These cutting systems result in different distributions of seedfall.

In strip- and patch-cuttings.— In both strip- and patch-cuttings the seed distribution originates from a solid edge of trees. Most of the seed falls close to the parent trees. More seed is distributed to the south and east than to the north and west because of the prevailing northwesterly winds. The sound seeds do not travel as far as the empty seeds.

These facts were learned by observing cuttings on the forest and more exactly by studying the seedfall from a densely stocked square block of 35-year-old Virginia pine (Table 1). In this study thirty ¼-milacre seedtraps were located on lines perpendicular to the north, east, south, and west borders of the block. The traps were placed 10, 30, 60, 100, and 150 feet from these edges.

Using the data collected during the study of seed distribution from a block of pine trees, seedfall models were arithmetically constructed (Figs. 1 and 2) to show how seed probably falls on strip- and patch-cuttings in pure Virginia pine stands. The models of two clearcut strips show that, as the strip is made wider, relatively less seed falls in the center and on the windward side than on the lee side. In fact, more than one-half the area on the 200-foot strip gets 5 to 20 thousand fewer seeds per acre than any point on the 120-

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[1]The authors thank Richard H. Fenton, Northeastern Forest Expt. Sta., and David Sowers, Jr., West Virginia Pulp and Paper Company, for their assistance in obtaining annual seedfall records.

TABLE 1.—DISSEMINATION OF VIRGINIA PINE SEED BY DISTANCE AND DIRECTION FROM THE EDGE OF A PURE STAND, ANNUAL AVERAGE FALL, 1952-1954

Distance from stand (feet)	Direction from stand			
	North	East	South	West
	Thousands of seeds per acre			
10	48	79	85	17
30	24	68	72	21
60	15	39	36	16
100	15	15	11	1
150	5	12	8	3
	Percent of sound seeds in total seedfall			
10	33	27	28	30
30	28	33	31	43
60	36	24	41	17
100	36	46	37	0
150	0	22	16	0

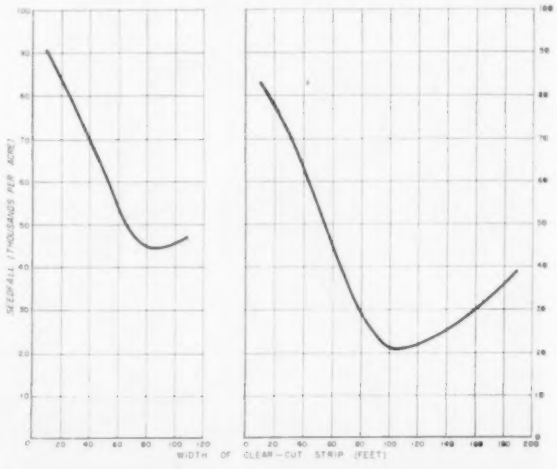

FIG. 1.—Distribution of Virginia pine seedfall in model strip-cuttings of two different widths in pure pine. Width of the strips is measured from direction of prevailing wind.

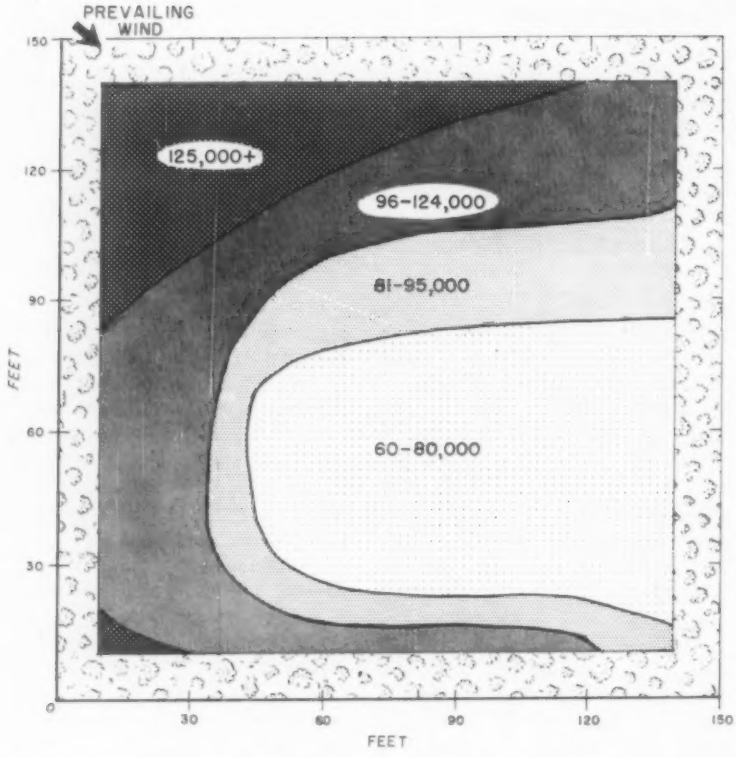

FIG. 2.—Distribution of seedfall on model ½-acre clearcut patch in pure pine; Average annual seedfall on different sections is shown in numbers per acre.

FIG. 3.—Seed-tree cutting with 31 Virginia pine seed trees left per acre.

foot strip. The curves are dipper-shaped because seedfall from the bordering uncut strips overlaps. This overlap also explains why more seed falls toward the edges of the narrower strip.

The seedfall on strip-cuttings in pine-hardwood stands on the Beltsville Experimental Forest has been low compared to the models (Table 2). The difference is due, at least in part, to the fewer pine trees in the mixed stands.

Large numbers of seed can drop on a small clearcut patch. Seedfall on the model ½-acre patch (Fig. 2) never goes below 60,000 per acre. Perhaps this explains why most small patch-cuttings on the Beltsville Forest have been successfully regenerated.

In seed-tree cuttings.—The seed-tree system offers reasonable possibilities for getting a large number of Virginia pine seed well distributed in a cutting area. In two seed-tree cuttings on the Beltsville Experimental Forest (Table 3, Stands A and B), large crops of seed were produced nearly every year during the period when measurements were taken. Except during the peak seed years of 1953, 1957, and 1958, the seed was fairly evenly distributed over the area.

The importance of numbers in relation to quality of seed trees was examined in a small study. On separate 5-acre plots (Fig. 3), 31 and 11 seed trees each were left. The average annual seedfall was:

Plots	*Seeds per acre*	*Seeds per tree*
31 seed trees per acre	110,000	3,500
11 seed trees per acre	92,000	8,400

. The plot with 31 seed trees per acre received only one-fifth more seed even though it had almost three times as many seed trees. Lower seed-fall per tree explains this; in order to get 31 seed trees per acre, crowns of poor seed-productivity were left. Thus, a short-

TABLE 2.—ANNUAL VIRGINIA PINE SEEDFALL ON CLEARCUT STRIPS OF DIFFERENT WIDTHS IN PINE-HARDWOOD STANDS

Year	Width of cut strips	
	3 chains	2 chains
	Thousands of seeds per acre	
1953	18	—
1954	12	17
1955	10	65
1956	6	7
1957	40	28
1958	—	60

age of good seed-producing trees can be offset only in part by leaving more seed trees per acre. Sometimes, as in stands C and D (Table 3), there are no good seed-producing trees and the number left standing is of no consequence.

These results suggest that if seed trees are carefully chosen it may not be necessary to leave 30 or 40 per acre as was done in Stands A and B (Table 3). However, windthrow may quickly reduce the number of seed trees (Table 3, Stands A and B), and there is need to allow for such losses in selecting the number of seed trees to leave.

TABLE 3.—VIRGINIA PINE SEEDFALL ON FOUR SEED-TREE CUTTINGS

Stand	Year	Growing seasons since logging	Seed trees per acre[2]	Seedfall	
				Total	Average per tree
			Number	*Thousands*	*Thousands*
A[2]	1950	0	40	139	3.5
	1951	1	33	37	1.1
	1952	2	30	36	1.2
	1953	3	29	260	9.0
	1954	4	24	40	1.7
	1955	5	20	19	1.0
	1956	6	20	—	—
	1957	7	20	85	4.1
	1958	8	20	25	1.2
B[3]	1955	1	31	19	0.6
	1956	2	30	8	0.3
	1957	3	29	76	2.6
	1958	4	27	114	4.2
C[4]	1953	0	10	0	0
	1954	1	10	0.3	0.03
	1955	2	10	.1	.01
	1956	3	10	12.2	1.2
	1957	4	10	6.2	.6
D[4]	1953	0	10	0.4	0.04
	1954	1	10	2.2	.2
	1955	2	10	.7	.07
	1956	3	10	7.4	.7
	1957	4	10	10.4	1.0

[1]Decrease in numbers in Stands A and B was due to windthrow.
[2]Trees about 50 years old, 60 feet tall at Laurel, Md.
[3]Trees about 60 years old, 60 feet tall at Laurel, Md.
[4]Trees about 45 years old, 30 feet tall at Springfield, W. Va. These trees were residuals of a 1943 cut on the lands of the West Virginia Pulp and Paper Company, and were not deliberately selected for seed production.

Variations In Seed Production and Viability

Seed years.—Virginia pine produces "abundant seed . . . every year," Sterrett wrote in 1911 (*3*). Results of our studies indicate that the species is not quite so reliable a seed producer. Though Virginia pine stands commonly produce some seed annually, the amount and viability varies greatly from year to year (*1*).

Seed collections from four Maryland stands (Tables 2 and 3) and others on the Beltsville Forest show that 1950, 1953, 1957, and 1958 were much better seed years than 1951, 1952, 1955, and 1956. The reasons for these non-rhythmic variations are not understood. Seed viability during this period ranged from a low of 20 percent in poor seed years to a high of more than 80 percent in good seed years.

Response to release.—Release of mature Virginia pine appears to stimulate seed production. As with loblolly pine (*4*), increased production begins during the third growing season after release. Thus, the exceptionally plentiful seed crops observed in Stand A in 1953, in Stand B in 1957, and in Stands C and D in 1956 (Table 3) might well be attributed to release. Although this evidence is fragmentary, a prelogging release of Virginia pine seed trees to increase seed production may be worthwhile.

Differences among trees and stands.—Virginia pine trees differ enormously in the number of cones they produce. There are even wide differences among entire stands. The reasons for these differences are imperfectly understood, but light and age are known to be important. Slocum and Miller (*2*) noted that open-grown trees and many dominants within a stand produce cones every year, while small trees in dense stands do not produce cones. They also reported that cone production increases with age, partly because stands become more open as they grow older. Our observations in Maryland and West

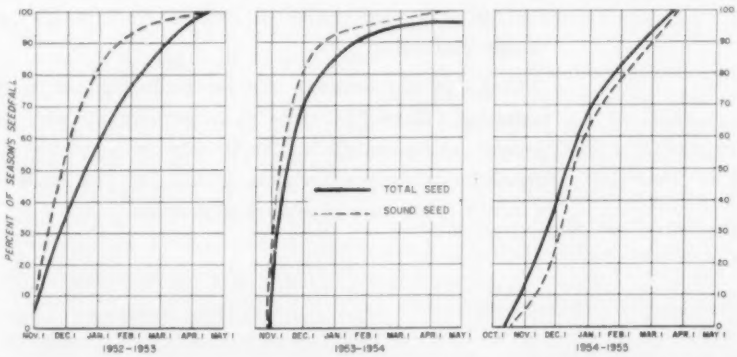

FIG. 4.—Time of year when Virginia pine seed fell during 1952-1953 seed years.

Virginia support these findings.

However, distinctions based on light and age do not explain why like stands or like neighboring trees consistently differ in cone production. Nor do they explain why small crowned trees in dense stands sometimes produce more seed than larger crowned trees in open stands.

These wide differences, whatever their cause, should be considered before relying on trees or stands to provide seed for natural regeneration. The best guide to future seed production is past production; trees black with old cones will probably be good producers in the future.

Time of Seedfall

To find when Virginia pine seed falls, weekly collections from thirty ¼-milacre seedtraps were made from October through March or April during the seed years 1952-1954. Seedfall, it was found, began in late October and continued until May and possibly longer (Fig. 4). However, most of the seed fell during the first 3 months. Each year the rate of total seedfall was different; even the comparative rates of sound seed to empty seed varied.

Summary

The seeding characteristics of Virginia pine were studied on the Beltsville Experimental Forest, Laurel, Md., and on two stands near Springfield, W. Va. Seed dissemination from the north, east, south, and west edges of an uncut block of 35-year-old pine was measured from 1952 through 1954. Annual seedfall from many stands, including four seed-tree cuttings and two strip-cuttings, was sampled beginning in 1950. Observations were made on the annual variations in seed production among stands and trees. The time during which Virginia pine seed falls from the cone was examined.

The results of these studies are:

1. Most Virginia pine seed is distributed by the prevailing winds; most falls within 100 feet of the stand in which it is produced.

2. A shortage of good seed-producing trees can be offset only in part by leaving more seed trees per unit of area.

3. During the period 1950 to 1958, the best seed years were 1950, 1953, 1957, and 1958.

4. Release of Virginia pine trees may stimulate seed production.

5. Variations in seed production among individual Virginia pine trees and stands are often great. The best guide to future seed production by individual trees is their past production.

6. Virginia pine seed begins to fall in late October and continues until the following May. Most of the sound seed falls during October, November, and December.

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Estimating Oven-dry Weight of Pulpwood in Standing Ponderosa Pines

Clifford A. Myers

SINCE PULP PRODUCTION is measured by weight, the wood requirement is determined by units of weight. The weight of wood is determined by its density in terms of pounds of moisture-free wood substance per cubic foot or per cord. If tree weights could be determined without appreciable added cost, the raw material and product could be measured in a common unit at all stages of harvest and manufacture.

Pulpwood-sized ponderosa pines (*Pinus ponderosa* Laws.) were measured to determine the possibility of using readily observed tree and stand characteristics to cruise standing trees by weight.

Other Work

Numerous studies have attempted to determine the tree and site factors that cause variations in the specific gravity of wood. Trees in dense stands may produce heavier wood than those in open stands (*2, 5*). Though wide annual rings have been associated with low specific gravity (*7*), other studies indicate little or no correlation between specific gravity and ring width or rate of growth (*4, 11*). Specific gravity may increase with age (*11*) regardless of changes in ring width. Trees of the lower crown classes (*12*) and small-crowned trees (*5, 7*) can produce heavier wood than the more vigorous trees of a stand. In some studies, wood weight appeared to be influenced by soil properties and site quality (*6, 8*) but not in others (*10*). Zobel (*13*) stated that the reported strong correlation between wood density and such factors as site quality, moisture, growth rate, and crown size did not hold true for loblolly pine within the range of desirable growth rates.

At least two attempts have been made to make tables for estimating wood weight in standing trees. Hildebrandt (*1*) presented yield tables for German spruce in units of oven-dry weight of wood substance. Schwappach's (*9*) tables gave the average weight of entire stems at the end of each of several 30-year periods.

Materials and Methods

Sixty-eight ponderosa pines were selected at random from 19 plots throughout the Black Hills of South Dakota. Thirty-nine trees were from stands thinned about 22 years before measurement and 29 were from unthinned stands. All trees were of the sizes and condition currently cut for pulpwood in thinnings except that forked and small, old ("yellowbark") trees were not included. A full range of readily measured tree and stand conditions was sampled (Table 1).

After the trees were measured and felled, they were cut into 4-foot lengths, plus additional short top sections to a 4-inch diameter inside bark. Average diameters inside bark to 0.1 inch and lengths to 0.1 foot were measured on each piece. All bolts were then peeled and piled in pens[1] in an open field until air dried below 24 percent moisture content. Most bolts were dried to 15 percent or less.

Oven-dry weights were calculated from moisture contents determined with a resistance-type moisture meter. The air-dried bolts were weighed to 0.1 pound. Sections 1 foot long were cut from each end of bolts that were 3 to 4 feet long. Shorter bolts were cut once at the middle. Moisture contents were measured along an average radius on each cross section, with the distance between measuring points equal to the width of the moisture meter electrode. The number of measurements per cross section thus depended on its diameter. Meter readings were corrected to moisture percentage by using the ponderosa pine calibration table supplied with the meter. Average moisture content of each bolt was determined by weighting each percentage by the area of the part of the cross section sampled. Oven-dry weights of the bolts were then computed from the weighted average moisture percentages and the air-dry weights.

Six randomly selected bolts were oven-dried to provide a check on the accuracy of the determination of dry weight. Each bolt was split into pieces less than one inch thick and oven-dried until there was no appreciable loss in weight. The bolts were then weighed to 0.1 pound.

Cubic-foot volumes of the bolts

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Research reported in this article was conducted by the station's field unit at Rapid City, S. D., in cooperation with the South Dakota School of Mines and Technology.

[1] A loose, rectangular stack in layers of two pieces each.

and short top sections were computed by Smalian's formula. These volumes were totaled to get the merchantable volume in each tree. Volumes were determined to 0.01 cubic foot.

Results and Discussion

Weights of the six oven-dried bolts indicated that the oven-dry weights calculated from moisture contents averaged 1.75 percent low. The combined effect of possible errors in the measurement of volume, weight, and moisture contents was, therefore, not large. The equations and other results presented are not corrected for this average error.

Merchantable cubic-foot volumes and calculated dry weights were closely correlated (Fig. 1) without stratifying the data by treatment, site, or other measured variables. The relationship was:

$$W = 25.0688(V) - 3.0096 \quad (1)$$

where W is the oven-dry weight of the merchantable bole in pounds and V is the corresponding volume in cubic feet. The correlation coefficient (r) was +0.992, indicating that 98 percent of the variance in weight was accounted for. Regression lines for thinned and unthinned stands did not differ significantly from each other.

Oven-dry weight can be determined from tree diameter and merchantable length by use of the logarithmic tree-weight equation:

$$W = 1.46847D + 1.04867H - 0.74002 \quad (2)$$

where W = logarithm of oven-dry weight of the merchantable bole in pounds

D = logarithm of diameter breast high in inches

H = logarithm of merchantable length in feet.

The multiple correlation coefficient (R) was 0.988. Adding the other independent variables listed in Table 1 to the equation did not improve the estimation of dry weight.

The 68 trees averaged 24.5 pounds per cubic foot, with a specific gravity of 0.393. Density of the entire merchantable bole of single trees ranged from 21.4 to 27.9 pounds per cubic foot. There was no significant difference in the density of trees from thinned and unthinned stands nor was there a correlation between wood density and any of the measured variables. Landt and Woodfin obtained an average density of 24.8 pounds per cubic foot (specific gravity 0.398 by the immersion method) for pulpwood-sized trees in the Black Hills (*3*). They also found no significant difference in average density between thinned and unthinned stands. About the same density was obtained with the 68-tree sample described here if allowance is made for the possible 1.75 percent error.

Diameter and merchantable length are the only measurements needed for determining the weight of standing immature trees currently available for pulpwood in the Black Hills. Two procedures may be used to estimate merchantable dry weight from cruise data. Diameters and lengths can be converted to cubic-foot volumes by using a suitable volume table. This volume multiplied by 24.8 will give the oven-dry weight of the merchantable parts of the trees. Alternatively, a weight table similar in form to a standard volume table could be constructed from equation 2. Weights could then be determined directly for each combination of d.b.h. and merchantable length. The total weight determined from the table should be increased by 1.75 percent, based on results of oven-drying the six

TABLE 1.—RANGES OF TREE AND STAND VARIABLES MEASURED

Variable	Range
Diameter breast high	6.0—11.5 inches
Merchantable length	10—47 feet
Form quotient	.50—.82
Age on stump	38—87 years
Crown class	Dominant—overtopped
Crown diameter	4.4—17.8 feet
Crown length	12.7—34.0 feet
Percent tree length in crown	31—74 percent
Site index (base 100 years)	47—67 feet
Stand basal area	70—260 square feet per acre

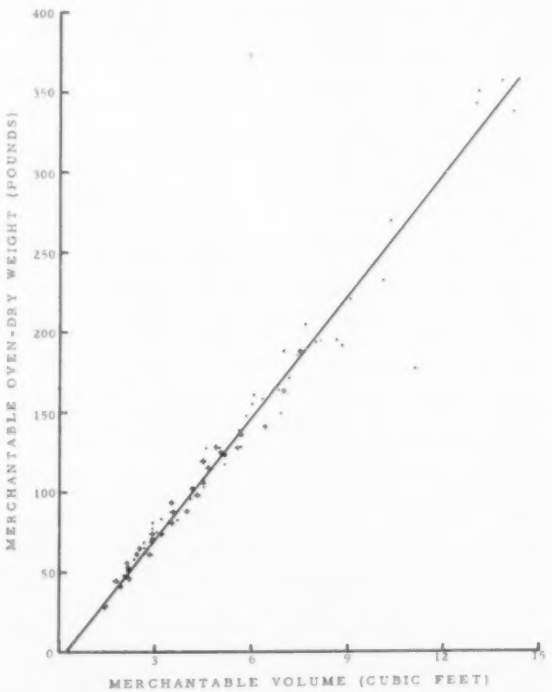

FIG. 1.—There is a very close correlation between bole volume and oven-dry weight in pulpwood-sized ponderosa pines in the Black Hills. Dots represent trees from thinned stands; crosses, those from unthinned stands.

sample bolts.

With either procedure, the computed weight of any one tree can be incorrect because of departure from the average volume and density of its size class. The total weight of a number of trees, however, can be determined by using either density and volume or equation 2.

The lack of correlation between tree weight and variables other than diameter and merchantable length agrees with conditions in the Black Hills. The range in site quality is narrow as is the range in the age of stands currently available for pulpwood thinnings. Studies now in progress indicate that there is little change in specific gravity of bole-wood after thinning. A wide range of stand densities were sampled, but stand density could not be correlated with the density of the merchantable bole. This was probably due to the low correlation between ring width and specific gravity in immature Black Hills ponderosa pine.

Conclusions and Summary

Sixty-eight ponderosa pines were selected throughout the Black Hills from stands ready for pulpwood thinning. Oven-dry weights of the merchantable boles were calculated from air-dry weights by using moisture contents determined with a moisture meter. These weights were correlated with several readily observed tree and stand characteristics to test the accuracy and practicality of cruising trees by weight.

The oven-dry weights of the merchantable boles and their cubic-foot volumes were closely correlated. Regression lines for thinned and unthinned stands did not differ significantly.

Two procedures can be used to compute pulpwood weight from cruise data. Plot cubic-foot volumes can be multiplied by 24.8, the number of pounds per cubic foot. Weight can be computed directly from measured diameters and merchantable lengths and a logarithmic tree-weight equation. Either procedure will give the total weight of a number of trees. The weight of any one tree can differ from the average of its size class.

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Coppice Book Again Available

In 1938 there was privately printed in Greece a book titled *Der Ausschlagwald—Besonders in Europa—und seine Umformung in Hochwald* by Johannes K. Papaioannou. The equivalent title in English is *The Coppice Forest, Particularly in Europe, and Its Conversion to High Forest.*

The book was reviewed in the JOURNAL OF FORESTRY in 1939 (pp. 588-590) but because of World War II it was not available in the United States. The author has notified the JOURNAL that copies may now be purchased for $5 each from Edward G. Palmer, 7936 Karlov Ave., Skokie, Ill.

Because coppice forest conversion continues to be an important silvicultural and forest management problem in many countries, this book, written by the professor of forestry in the University of Thessalonik, will be of interest to foresters who plan to convert low-grade hardwoods to high forests of conifers and better-grade hardwoods.

Soil Moisture Regime in Southwestern Wisconsin as Affected by Aspect and Forest Type

J. H. Stoeckeler
and Willie R. Curtis

It is commonly recognized that north-facing slopes produce better timber than south-facing slopes. The basic cause of this is the difference in solar radiation. This affects the rate of evapotranspiration, which, in turn, affects the supply of available moisture. The net result is faster depletion of soil moisture on south slopes. This is important not only to plant growth, but also to watershed hydrology. If south slopes lose water faster, they will have greater soil moisture deficits, hence may contribute less usable water.

Also important is the relative difference, if any, in the use of water by different kinds of cover and the interaction of cover and topographic conditions.

Little quantitative information is available on these relationships. Potzger (*6*) observed substantially better soil moisture on north slopes than on south slopes in central Indiana, verifying a principle observed by Bates (*1*) in a previous study in Colorado. Bates also observed a 40- to 75-percent higher water loss from evaporimeters on the south slopes in July and August and markedly higher soil surface temperatures, often 30 to 50 degrees higher, on south slopes.

No reports on this subject have been made for the Driftless Area of southwestern Wisconsin and southeastern Minnesota. This paper discusses the results of a preliminary investigation of the soil moisture regime in natural woods and pine plantations in the unglaciated loessal soils of southwestern Wisconsin. The study, made in 1957, was limited to the growing season only and did not trace soil moisture behavior throughout the year. Aspect and position on slope were associated variables.

The pattern of moisture obtained by aspect and topographic position helps explain the growth and species distribution of hardwoods within the Driftless Area. The results of a comparison between the pine and hardwoods indicate the feasibility of converting some of the poor oak stands to pine plantations—a common recommendation in this area.

The authors are soil scientist and research forester respectively of the Lake States Forest Expt. Sta., Forest Service, U. S. Dept. Agric., maintained at St. Paul, Minn., in cooperation with the University of Minnesota.

The Study Area

The soils of the area are mostly Dubuque-Fayette silt loams of loessal origin. They are underlain by limestone, sandstone, or delomite (*3*). The average annual precipitation in the area is about 32 inches, with about 20 inches falling in the months of May through September. The frost-free period is about 163 days (late April to early October). Average January temperature is 16.1° F. and average July temperature is 72.8°, with a maximum of 108° F. and a minimum of −43° F. having been reported (*7*).

Several study areas were sampled:

1. The chief study area was a north-south transect across an east-west valley known as Bohemian Valley, which lies at the headwaters of Coon Creek. The tract is about 15 miles east of La Crosse, Wis. The valley floor is about 800 feet wide, and the maximum differences in elevation between the valley floor and the top of the ridges on each side of it are 350 and 300 feet respectively for the north-facing and south-facing slopes. The elevation of the valley floor above sea level is 900 feet.

There was no evidence of recent grazing on any part of the transect. The transect was in native hardwoods. An undisturbed layer of organic matter was present. Bulk density ranged from 0.54 to 1.03 for the top 3 inches of soil profile.

The north-facing slope, with about 2 feet of soil over bedrock, was occupied by 2- to 3-log timber (referring to 16-foot logs) of basswood, sugar maple, American elm, rock elm, butternut, and red and white oaks. The south slope was occupied by a rather scrubby oak stand. The stand at the base of the slope had a few 1- and 1½-log trees, but the upper slope stand was nonmerchantable.

The valley bottom had a deep alluvial soil at least 6 to 7 feet deep and had typical bottomland hardwood timber of ash, elm, and basswood. Volumes by slope position were:

Aspect	*Position on slope*	*Timber volume per acre* (Bd. ft.)
North	Upper	4,672
	Middle	7,735
	Lower	6,215
Flat	Valley bottom	11,420
South	Lower	3,458
	Middle	3,212
	Upper	538
Slightly north	Top of ridge[1]	4,470

Volumewise, the sawtimber quantity was about 6.2 thousand compared with 2.4 thousand board feet per acre on north- and south-facing

[1]Above south-facing slope. This ridge had a slight slope to the north. The ridge above the north-facing slope was not timbered.

slopes respectively, or a 2.6 to 1 ratio. Cordwood volume had a ratio of 2 to 1 on the north compared with the south aspects. Einspahr and McComb (*2*) and Locke (*4*) have reported a similar contrast in the productivity of north versus south slopes.

2. Two nearby plantations were also studied. One was a 55-year-old Scotch pine stand on a south slope which had a volume of about 12 thousand board feet per acre. The other was a 55-year-old white pine planting on a north slope with volumes in the range of 7.2 to 20.8 thousand board feet per acre.

Materials and Methods

Soil moisture samples were taken by 1-foot levels with Viehmeyer tubes on five different sampling occasions. Samples were taken until rock was struck, or to a depth of 7 feet. They were placed in metal moisture cans, weighed, dried, and reweighed.

Stations were generally sampled in quadruplicate. In the transect study, stations were located on upper, middle, and lower slopes, and in the valley bottom. Two pairs of 1/10-acre plots were taken at each station.

Timber volumes were taken in the conventional manner, using a diameter tape and estimating merchantable heights to the nearest half log, and 100-inch-long pulpwood to a 4-inch top diameter. Merchantable heights were checked frequently by instrument.

Rainfall was measured by one recording and one standard rain gage placed near the study area. Precipitation was above normal for June, July, and August, but was below normal for September. Rainfall for the 4 months was 7.32, 4.64, 4.10, and 2.08 inches respectively. Expressed in percent of normal

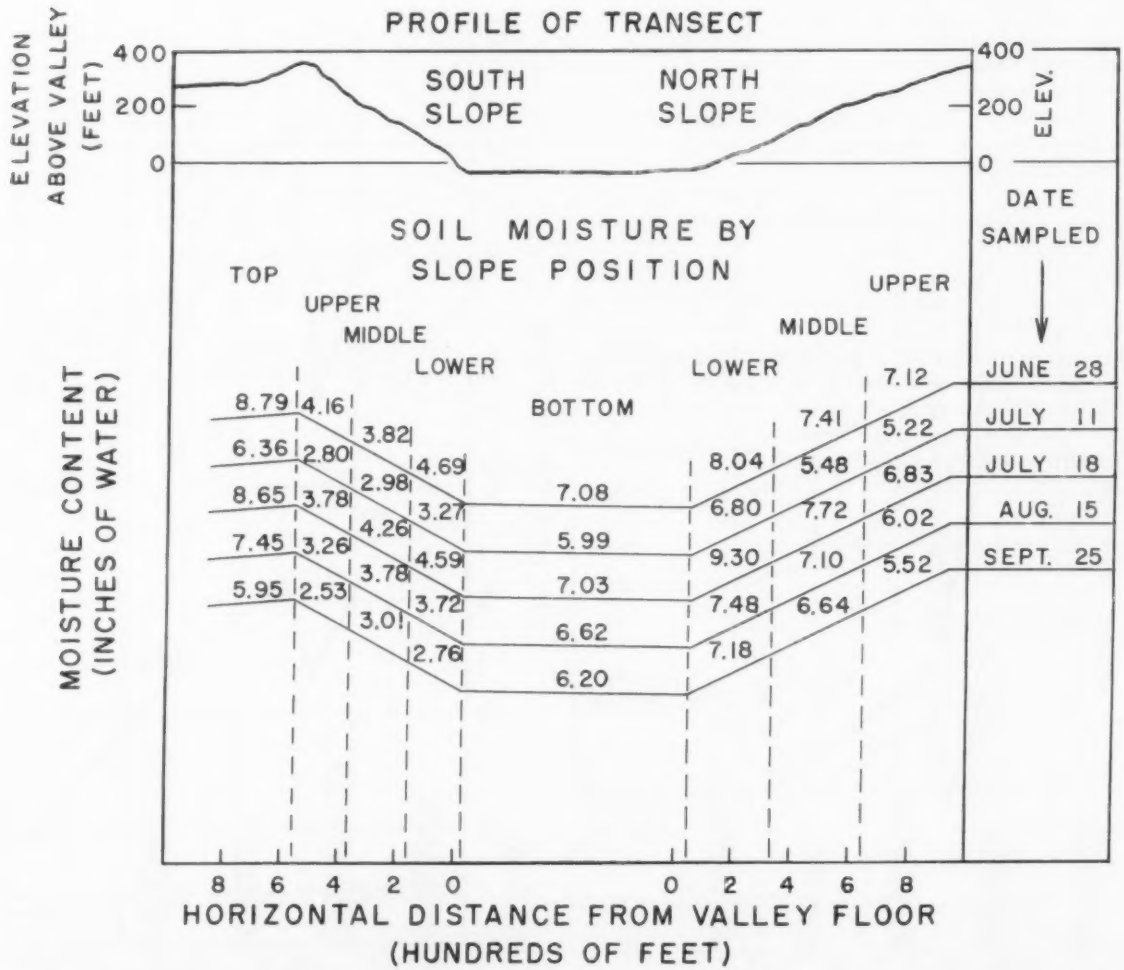

FIG. 1.—Soil moisture along a valley transect. The upper slope position on the south aspect was sampled to a 1-foot depth; data for all other positions are for the upper 2-foot depth.

precipitation, these values are 189, 145, 125, and 47 percent respectively.

Results

Soil moisture is shown only for the upper 2 feet of soil—the sampling depth common to practically all plots and also corresponding to the zone of most abundant rooting. Since samples were relatively stone-free, they were not corrected for stone content.

The data have been plotted in graphic fashion to illustrate the major contrasts in soil moisture between forest types and topographic conditions. Continuous lines in the plottings do not necessarily indicate moisture content of the soil between sampling dates; they are used merely to simplify presentation. Analyses of variance and "t" tests were used to test the significance of the differences.

Effect of topography.—Samples collected at various topographic positions along the wooded transect provide a measure of soil moisture by slope position. A profile of the wooded transect is shown in Figure 1.

The figure also shows the total inches of moisture in the upper 2 feet of soil on five sampling dates for the different slope positions and aspects. The data were replotted to scale in Figure 2 to illustrate the differences. These are discussed below.

On the north-facing slope there was a regular and gradual increase in soil moisture from the top to the bottom of the hill for all five sampling dates. The south-facing slope does not show this so clearly. However, the upper slope position on the south aspect could be sampled to a depth of only 1 foot; and this may tend to obscure the trend since all other plots were sampled to at least 2 feet.

Each position on the north-facing slope shows a substantially higher soil moisture content than the similar slope position across the valley. For instance, in the lower slope positions the north slope had approximately 4 inches more water at any sampling date than did the south slope. In the middle slope positions the difference was about 3 inches. Since the upper slope positions were not sampled to a common depth, comparison may not be meaningful.

Shallow soil on the upper slope of the south aspect may account

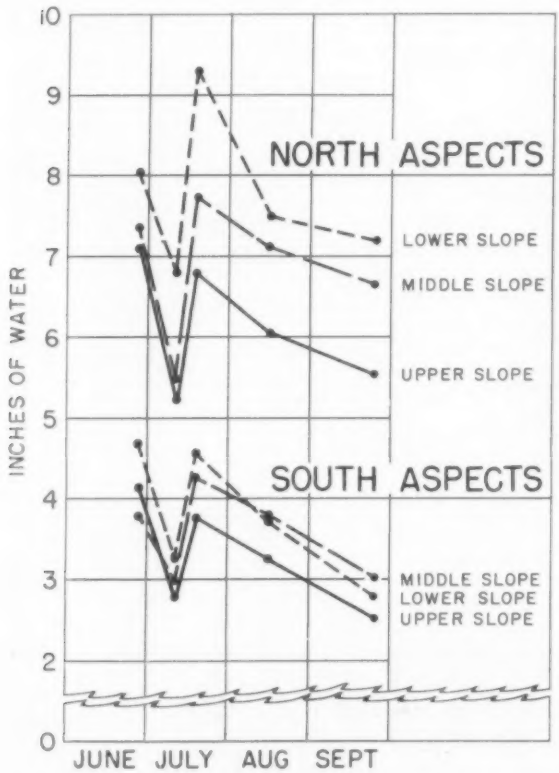

FIG. 2.—Effect of slope position on soil moisture along a valley transect.

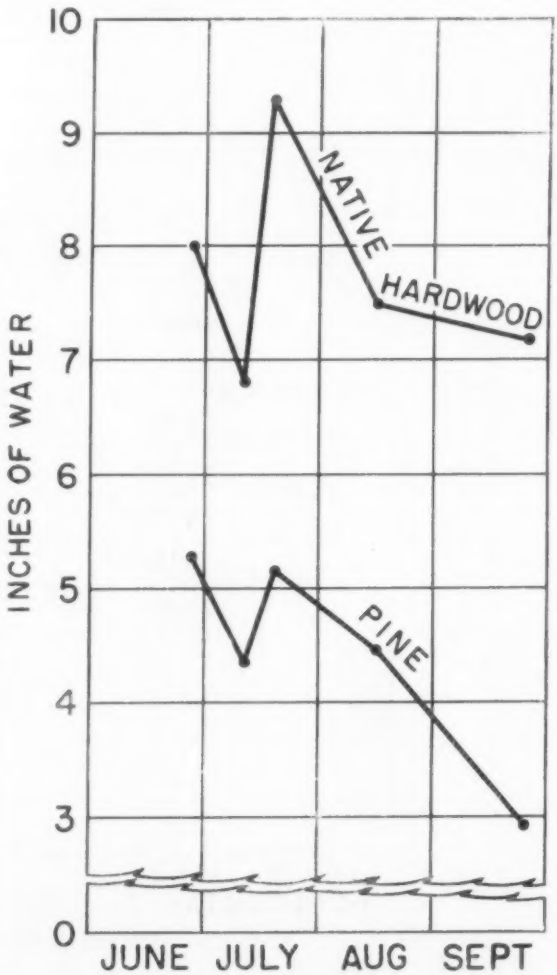

FIG. 3.—Effect of vegetation on moisture in the upper 2 feet of soil, lower slope position, north aspect.

for the higher moisture content found on the middle slope on two of the five sampling dates. Excess moisture from the shallow soil probably moved downhill over the bedrock.

Moisture content for the surface 2 feet in the valley bottom was generally lower than on the ridgetop or on the middle and lower slope positions of the north aspect, but higher than at any slope position on the south aspect (Fig. 1). However, soils were deeper here than on the slopes, so total available moisture was undoubtedly much higher.

The ridgetop, with a slightly north-facing slope, contained a comparatively high moisture content, second only to the lower position on the north aspect. Soils on the ridgetop were of a silt loam texture, with a silty clay loam subsoil, and the bulk density of the upper 2 feet of soil exceeded that of any other plot along the transect. This, along with the favorable aspect, may partially explain the high moisture contents.

Differences between the upper and lower slope positions on the north aspect were significant,[2] but the differences between the lower versus middle and middle versus upper slope positions were not significant. There were no significant differences by slope position on the south aspect.

Effect of vegetation and aspect.—To study the effect of vegetation, soil moisture in the hardwoods along the transect was compared with that in the two pine plantations. Since the pine plantations were also on north and south slopes, there was provided a measure of soil moisture in the two forest types for both aspects.

On the north aspect the native hardwoods held more moisture than did the pine plantation (Fig. 3). At the beginning of the study the difference was about 3 inches. This difference increased to about 4 inches by the end of the sampling period and was found to be highly significant.

On the south aspect soil moisture under the hardwoods was very similar to that under the pines, with slightly more moisture under the hardwoods except for the last sampling date (Fig. 4). These differences were not significant.

Aspect differences by type are shown in Figures 5 and 6. In the hardwoods (Fig. 5) the north slope had about twice as much moisture as the south slope. The differences were highly significant. In the pine plantations (Fig. 6) the north slope had about one-fourth to one-third more except for the last sampling date. These differences for the first four sampling dates were significant.

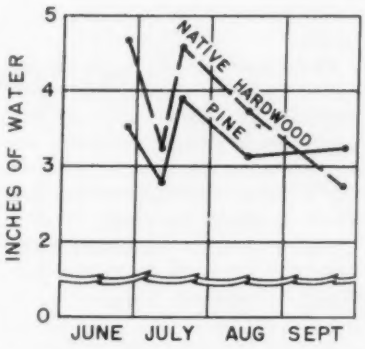

FIG. 4.—Effect of vegetation on moisture in the upper 2 feet of soil, lower slope position, south aspect.

Discussion

Hardwood type.—The differences in soil moisture across the wooded valley show a logical trend and help explain the differences in tree volume per acre by aspect and topographic position. All the slope positions with a north aspect had almost twice the amount of moisture available for growth as the corresponding slope positions with south aspects. Timber volumes were in the ratio of 2 to 1 for

[2]Significant refers to odds of 95 out of 100. Highly significant refers to odds of 99 out of 100.

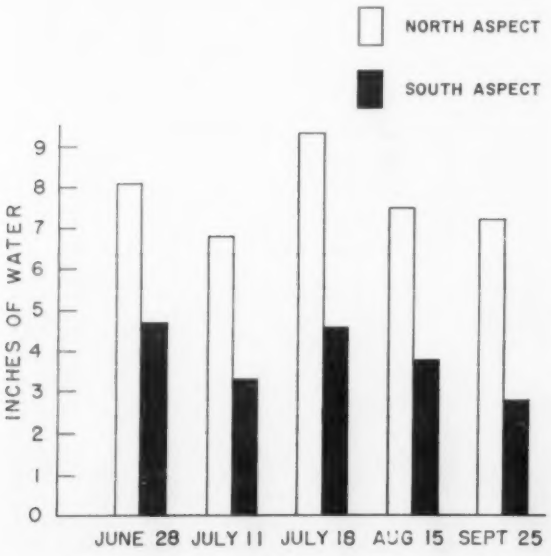

FIG. 5.—Effect of aspect on moisture in the upper 2 feet of soil, lower slope position, native hardwoods.

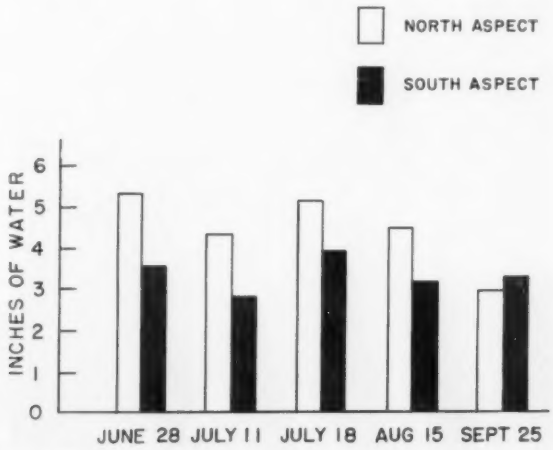

FIG. 6.—Effect of aspect on moisture in the upper 2 feet of soil in pine plantations on a lower slope position.

cordwood and 2.6 to 1 for sawtimber.

The range of soil moisture on the south-facing slopes from top to bottom was smaller than on the north-facing slopes. Actually, except for a narrow band adjacent to the bottom, soil moisture was low on all south-facing plots.

Pine versus hardwood.—The trend of soil moisture under pine versus hardwood becomes more meaningful when discussed by aspect. On the north-facing slopes the dense pine plantation had less moisture during the period of rapid growth than did the hardwood stand (Fig. 3). On the south-facing aspect where moisture was more limiting, the difference was small (Fig. 4).

Since pine versus oak volume had a ratio of 3.5 to 1 on the lower south slopes studied, it appears that pine conversion on the driest slopes may have a place silviculturally without drastically altering the soil moisture regime. Even on the upper slope position on north exposure, the volume ratio of pine to hardwood was 1.5 to 1. Minckler (*5*) recommended conversion of drier south slopes to pine as a good management practice.

Summary

Soil moisture in the top 2 feet of soil was significantly higher in a north-facing than in a south-facing slope on five different sampling dates along a transect in native timber across an east-west valley near La Crosse, Wis., in 1957. It was about twice as high on the north as on the south slope.

On the north slope there was a regular and systematic increase in soil moisture from top to bottom of the slope. On the south-facing slope the trend also appeared but was less consistent because of presence of shallow ledge rock on the upper third of the slope and the recharge effect of the runoff from that zone on the middle third of the slope.

The moisture content under a northern hardwood forest on a north slope was almost double that under a white pine plantation on the same aspect.

But in stands located on south-facing slopes, moisture content in a Scotch pine plantation was fairly similar to that in native oak woods. Since the volume growth in the pine plantation was 3.5 times as high as in the scrubby oak stand, type conversion on the drier slopes by reforestation would seem to be a means of greatly increasing timber production on the farmwoods in the area.

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Notes and Observations

Strangling and Girdling Effects on Cone Production and Growth of Loblolly Pine

A study was established on the Crossett Experimental Forest in south Arkansas to determine the effects of strangling and ringing on the cone production and growth of 54 loblolly pines (*Pinus taeda* L.) in even-aged old-field stands. Diameters ranged from 3.1 to 14.9 inches. The trees were grouped into 18 sets of three trees each. Those within each triad were very similar with respect to diameter, crown size, and site. Age differences within diameter classes were small. One tree in each triad was strangled 12 inches above the ground, one was ringed at the same height, and one was left untreated. Trees which had borne few or no cones in the past were selected for the study in an effort to increase the severity of the test.

Ringing consisted in removing a strip of bark one inch wide in the form of two overlapping half rings with a 3-inch vertical separation between them (Fig. 1). For each half-ring, parallel incisions, one inch apart, were made with a wide chisel; the cuts went through the bark and no deeper. The bark strip and all the underlying cambial tissue were then peeled off with a one-inch chisel.

Strangulation was accomplished by placing a band of steel pipe-hanging strap, ¾-inch wide, around the bole (Fig. 2). The bark was first shaved smooth with a drawknife to insure firm contact of the band with the entire circumference of the tree. A bolt inserted through holes in the ends of the band permitted tightening and placing the bole under pressure at once. From then on, pressure increased automatically as the tree grew. After 18.5 months on the small trees and 36.5 months on the larger trees the bands were removed to prevent envelopment by swelling tree tissue.

Cone counts were made annually for 8 years, with 6-power binoculars. June was the best time for counting in this locality because the cones then had almost attained full size, but were still a bright light green which differentiated them from the darker foliage. Observations were most easily made early in the morning when the sun's rays penetrated the crown at a low angle.

Results

The average cumulative cone production per tree for each treatment is shown graphically in Figure 3. In eight years, trees 6 inches and smaller bore no cones at all, but

FIG. 1.—Method of ringing. The two half rings are one inch wide.

FIG. 2.—Method of strangling with steel band.

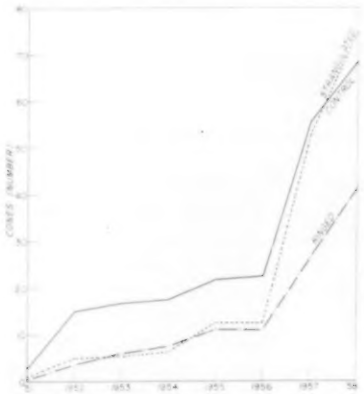

FIG. 3.—Cumulative cone production per tree.

TABLE 1.—DIAMETER AND HEIGHT DEVELOPMENT

Treatment	Average size 1950	Average size 1958	Average annual increase
	Diameter		
	Inches	*Inches*	*Inches*
Strangled	9.8	12.4	0.3
Ringed	9.4	11.8	.3
Control	9.9	12.4	.3
	Height		
	Feet	*Feet*	*Feet*
Strangled	61	74	1.6
Ringed	58	72	1.8
Control	61	75	1.8

trees larger than 6 inches had as many as 549. Cones were few on both the treated and untreated trees, especially during the first six years. At least 75 percent of the cones were brought forth during the last two years of the study. Average cone yield per tree by treatment for the 8-year period was: control 68, ringed 41, and strangled 75. Neither the over-all differences nor the differences within diameter classes were statistically significant. Neither ringing nor strangulation had a detrimental effect on diameter or height growth (Table 1). Ringed trees in particular grew remarkably well considering that so little functioning cambium had been left between the half rings.

Even though strangulation and ringing did not hamper or promote cone-bearing in this study, broad inferences cannot be drawn from these results. The fact that the trees selected for observation had produced few or no cones prior to the test indicates that they may have been inherently poor producers, incapable of responding to treatment. Normal producers might react differently to the same treatments.

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Circular Plot Establishment on Multislope Terrain

In the precipitously sloped Knobs Region of east-central Kentucky, the accurate establishment of sample plots commonly requires frequent abney and tape measurements to properly compensate for multislope terrain. Such activities are not only time consuming but also may serve to introduce a number of sources of error, particularly when working with some system of continuous forest inventory involving permanent sample plots. Based upon recent experience on the Berea College Forest it appears that the field technique of plot establishment in rough country can be facilitated by standardizing measurements to produce a uniformly circular surface plot which, upon projection to the horizontal plane, becomes elliptical in shape.

The basic procedures as used in forest survey projects in Formosa and North Carolina have been described by Bryant.[1] For steep uniform slopes such plot establishment involves the following steps:

1. Abney determination of an average slope class (percent, degrees, or feet per chain) along the steepest diameter of the plot.
2. Adjustment of the basic radius to conform to this slope class.
3. Application of the adjusted radius across all portions of the plot, regardless of slope.

This system presupposes a uniformity of slope which frequently is not characteristic of the severely dissected topography of the Central Appalachian Region. Consider the case of a 1/5-acre plot located on the multislope terrain of Figure 1. The average slope class of the steepest diameter is 40 percent (plus 20, minus 56). Referring to Bryan's formula-derived table an adjusted radius of 54.65 feet is employed to establish the plot boundary. It is important to note, however, that while radii *A* and *B* are direct slope measurements radii *C* and *D* must be perpendicular to *A* and *B* and must be measured on a horizontal plane to avoid serious area losses. The horizontal image of the circle thus established is a composite ellipse with a net acreage of 0.199 acre. The small error (approximately 0.2 percent in this particular case) associated with this technique would appear to be more

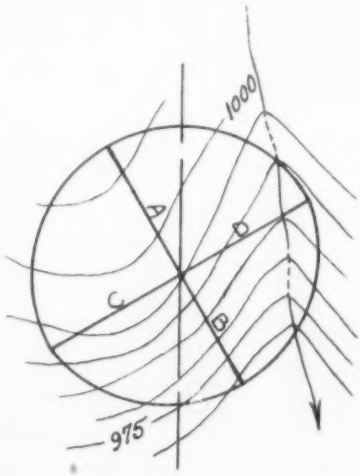

FIG. 1.—Elliptical projection of 1/5-acre sample plot located on multislope terrain: maximum slope class of 40 ($A = +20\%$. $B = -56\%$) with adjusted radius of 54.65 feet measured on the horizontal along *CD* and on the slope along *AB*. Measurement to borderline tree *X* would require 20 percent tape gradient.

[1] Bryan, M. B. A simplified method of correcting for slope on circular sample plots. Jour. Forestry 54:442-445. 1956.

subject to control than that which arises out of the series of slope adjustments made to establish the more conventional circular plot on a horizontal plane.

The adoption of this "multislope method" for the location of permanent plots on a 400-acre compartment within the Berea College Forest meant that on those plots with a 40 percent or greater maximum slope (41 cases out of 102) the use of the abney was limited solely to an initial slope class determination involving an average of two readings per plot. Plot boundaries were then speedily established by tape measurement alone.

Further application will be necessary to test its effectiveness in abnormally extreme topographical situations, but at the present time it can be said that in multislope country the technique materially increases the effectiveness of the cruising party with no impairment of cruising accuracy.

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Effects of Cleared-and-Burned Hardwood Slash on Growth of Planted Loblolly Pine in Livingston Parish, Louisiana[1]

Wood ashes have been used for centuries as a fertilizer rich in potash. In general they contain 5 to 25 percent K_2O; twigs and branches contain a higher percentage than trunkwood, and hardwoods are commonly richer than softwoods.

The literature contains numerous reports of the growth responses of tree seedlings where slash was burned before planting. Only a few of these records, however, come from this country, and only one such study is known in the South. Bruce[2] carefully studied the response of longleaf pine seedlings to the burning and ashes of sap pine logs. He reported about twice the stem caliper for seedlings on burned-log plots as compared to burned plots that had had only a grass rough. On plots (burned grass rough) where wood ashes were artifically placed, seedlings were not significantly larger than those without ashes. Bruce believed this response "due to the action of fire in killing grass roots rather than to any fertilizing or mulching effect of wood ashes."

The study reported on here involves a growth response of planted loblolly pine seedlings (*Pinus taeda* L.) that resulted from the burning of hardwood slash. A 55-acre tract in Livingston Parish, Louisiana, was cleared in October 1955. Hardwood brush consisting principally of sweetgum (*Liquidambar styraciflua* L.), yaupon (*Ilex vomitoria* Ait.), and waxmyrtle (*Myrica cerifera* L.) was sheared off at the groundline with a special bulldozer blade, windrowed, and burned. This brush produced a hot fire which burned about three hours. The area was planted in January 1956.

The study area was flat to very slightly rolling and with poor to imperfect surface drainage. Soils were silt loams in texture and represented poorly drained types in the Lintonia-Olivier-Calhoun catena.

Subsequent observations suggested that seedlings planted on burned windrows were outgrowing the "normal" seedlings between windrows. To verify this, measurements were made at the end of the second and third growing seasons on height, survival, and southern fusiform rust infection (*Cronartium fusiforme* Hedgcock and Hunt). Four blocks were selected at random; each block contained a burned windrow plot and a check plot which had not been burned. For this study, a plot consisted of a single row of planted trees long enough to provide 100 planting spaces. Table 1 summarizes the results of these measurements.

Differences in height of seedlings at the end of the second and third years between burned windrows and check plots were highly signifi-

TABLE 1.—HEIGHT GROWTH, SURVIVAL, AND FUSIFORM RUST INFECTION OF PLANTED LOBLOLLY PINE ON BURNED WINDROWS AND CHECK PLOTS

Measurement	Burned-windrow seedlings	Check seedlings
Height after second year, feet	6.21	3.17
Height after third year, feet	9.73	4.89
Annual height growth (first three years), feet	3.24	1.63
Survival, percentage	83	71
Fusiform rust (bole cankers), percentage	8.0	8.5

TABLE 2.—SOIL ANALYSIS DATA, BURNED WINDROWS VERSUS CHECK PLOTS, LIVINGSTON PARISH, LOUISIANA[1]

Soil test	1955 Clearcut		1956 Clearcut		1957 Clearcut	
	Burned windrows	Check	Burned windrows	Check	Burned windrows	Check
Avail. phosphorus, p.p.m.	22	8	65	6—	211	7
Avail. potassium, p.p.m.	146	24	405+	57	405+	69
Avail. calcium, p.p.m.	1296	270	5400+	810	5400+	216
Avail. magnesium, p.p.m.	158	53	229	123	438+	74
pH	6.8	5.2	7.4	6.1	7.5	5.5
Estimated texture[2]	v.f.s.l.	si.l.	si.l.	si.l.	si.l.	si.l.

[1]Soil analyses were made by the Louisiana State University Soil Testing Laboratory.

[2]Texture abbreviations: v.f.s.l. = very fine sandy loam; si.l. = silt loam.

[1]The assistance of A. P. Dubarry, Jr., former graduate student, Louisiana State University, in the collection of some of the data is gratefully acknowledged.

[2]Bruce, David. It isn't the ashes. Southern Forest Expt. Sta. Note No. 66:3-.4. 1950.

cant. Differences in survival and rust infection were not statistically significant. The survival difference, nonetheless, is believed to be real difference and deserves further study. Tipmoth infestation was virtually 100 percent for seedlings in both the burned and unburned plots.

Composite soil samples of the surface 6 inches of soil were taken from the above area in January 1958. Soil samples were also obtained from two other areas, one clearcut, windrowed, and burned in 1956, and one given the same treatment in 1957. These samples were tested for available phosphorus, available potassium, available calcium, available magnesium, and pH. The results are given in Table 2.

It is obvious from the soil analyses that the ashes left after burning resulted in very large increases in all four elements measured. Expressed in terms of the relative amounts of nutrients needed for productive agricultural land in Louisiana, these soils went from a "very low" or "low" rating in practically all cases to a "high" rating after slash burning. The normally acid soils became slightly alkaline after burning but with no ill effects on the pine seedlings.

The data from the three areas, cut and burned in three different years, suggest a leaching effect. The samples from the 1955 clearcut area which had withstood two years of leaching, had lower levels of all four elements than the more recently cut areas, but they were still appreciably higher than the unburned check samples. Apparently the holdover effects of such burning can be expected to last at least two years, and possibly longer.

No quantitative measurements were taken on the relative amounts of grass on sites with different treatments. Observations, however, indicated that there was very little grass on the entire tract before clearing, a scattering of bermuda and carpet grasses one year after treatment, and a fairly good cover of grass two years after treatment. This grass was present mainly in the "check" plots between windrows with relatively little on the burned windrows. A lush growth of briars and annual weeds typically occurred on windrows.

The soil analyses and other information presented here do not provide a conclusion as to *why* this growth response developed. Several possibilities suggest themselves: (1) increased soil nutrients, (2) reduced grass competition, (3) concentration of the best soil, and (4) improved soil aeration and drainage. The first two factors have been previously mentioned; the third and fourth result mainly from the inevitable scraping of some surface soil and the buildup of a slight ridge along the windrow. The dozer blade used in this work was specially designed to shear trees and not "push" them out of the soil; it effectively kept soil removal to a minimum.

More research is needed to determine which of the above variables caused the obvious spurt in growth, and how it might be artificially induced. Its importance stems from the slow height growth typical of many plantations during the first few critical years. Treatments that will relieve this slow growth caused by insect infestations, browsing, competition, or inherent characteristics are badly needed in most regions.

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Arizona State College, Flagstaff

Forest History Bibliographic Project Inaugurated

The Forest History Society has announced the inauguration of a three-year project to compile a bibliography of printed sources in the field of North American forest history. The Hill Family Foundation and the Weyerhaeuser Foundation, both of St. Paul, Minn., are joint sponsors of the project which has resulted from the recognition of the need for a systematic and comprehensive bibliography of such sources as an aid to scholarly research in the subject field. The project will be directed by the Forest History Society in its capacity as a central institution for the collection, preservation, and dissemination of North American forest history and the history of all forest related activities.

Elwood R. Maunder, director of the FHS, has appointed Joseph A. Miller, graduate M. A. of the University of Minnesota in American economic history, to compile the bibliography.

Book Reviews

Resources Development: Frontiers for Research

Ed. by Franklin S. Pollak. 333 pp. Illus. University of Colorado Press, Boulder. 1960. $3.75.

To evaluate this book, one must know events which explain its publication.

Here are published the papers of "speakers" (not those of discussants) of the Western Resources Conference held at the University of Colorado (Boulder), July 13-17, 1959. That conference was conceived initially by economists at the University of Colorado. When a title as broad as Western Resources Conference was chosen, two other tax-supported Colorado institutions—Colorado School of Mines (Golden) and Colorado State University (Fort Collins)—were included, and modified slightly, original plans for the conference.

Despite the broad title of the conference, only a few resources were considered. Except for water, few natural resource managers appeared as speakers or discussants. Professional men from natural resource management agencies and universities were invited—at a fee—to observe. Several of these asked why a Western Resources Conference was staged only by three Colorado schools to consider papers by experts who may be tallied—on the basis of fundamental training and interests—as 11 lawyers, 5 engineers, 5 professors from the government-political science-public administration complex, 2 chemists, and one each from public administration, economics, farm management, geology, and physics. Many speakers had become federal, state, or foundation officials.

Conference accents veered toward the economics and legality of exploitation. Fortunately several speakers and discussants refused to allow regional pride, politics, or commercial or professional desires to distort their judgments.

Contents, with emphases roughly indicated by pages involved, are as follows:

Western Resources and the National Interest. pp. 3-16.
  Land Policy and the Development of the West—in the National Interest.
Atomic Energy—Promise and Problems. pp. 17-38.
  Atomic Energy as a Resource.
  Atomic Energy and the Law.
Water. pp. 39-216.
  Toward Greater Availability.
  The South Platte River (Panel Discussion).
  A Geographer's Views of the Problems on the South Platte.
  Conflict on the Colorado River.
  Toward Better River System Planning.
  Ground Water.
  Water Law.
Land Use. pp. 217-236.
  Changing Patterns of Land Use in the West.
Minerals and Energy. pp. 237-278.
  Development of Mineral Resources Under Existing Mining Law.
  Potential of the Western Metal Mining Industry.
  Western Consumption and Production of Energy Resources.
Recreation. pp. 279-296.
  Are Western Recreation Resources Adequate to Meet National and Regional Demands?
  Recreation Uses: Protecting and Developing Them.
Vision and the Tasks at Hand: Research. pp. 297-315.
  Opportunity for Graduate Study and Research in the Resources Field.
  Inter-University Cooperation for Research in the Resources Field.
Index. pp. 317-333.

Readers interested in topics listed will find current problems analyzed informatively, even challengingly, but not always without bias. Speakers of the repute of Marion Clawson, Hatfield Chilson, R. G. Gustavson, Gilbert F. White, and Edward Woozley characteristically produced papers worth reading. Foresters can benefit much from reading the evaluations of resources, in part under their jurisdiction, by experts from other professions.

Unfortunately funds were inadequate to publish the papers of discussants, many of which equalled speakers' papers in merit. Nor does the editor inform readers that many discussants' papers are available from authors in mimeographed form. Furthermore, this publication, unlike many conference transactions, does not include valuable comments from professional men in the audience.

J. V. K. Wagar
Colorado State University College of Forestry and Range Management, Fort Collins

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Publications of Interest

The Lower Michigan Chapter of the Wisconsin-Michigan Section, SAF, has published two semi-technical bulletins for the use of foresters who are responsible for advising private forest landowners in the Lower Peninsula of Michigan.

The first of these, titled *Recommended Forest Cutting Practices for Lower Michigan*, was published in May 1959.

The latest publication is titled *Coniferous Tree Planting Practices for Lower Michigan*. This booklet, of 17 pages, is intended "to bring together in one publication all current knowledge and recommended practices for site selection and planting various species of coniferous trees in the Lower Peninsula of Michigan."

Copies of either of these two publications may be obtained from Ira W. Bull, Department of Forestry, Michigan State University, East Lansing, Mich. A charge of ten cents per copy is made to cover cost of mailing.

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The Geological Survey, U. S. Department of the Interior, has issued a

popular nontechnical pamphlet entitled *A Primer on Water*. Written by Luna B. Leopold, chief hydraulic engineer, and Walter B. Langbein, research engineer, the primer is in two parts. Part 1 covers the science of hydrology, which is concerned with the relation of water to earth. Part 2 discusses the magnitude and use of the total supply of water in the United States. Copies of this pamphlet may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 35 cents each.

* * *

How to Fertilize Trees and Measure Response is a booklet published by the National Plant Food Institute in cooperation with the University of Washington.

The authors are Dr. Stanley P. Gessel, associate professor of forest soils, School of Forestry, University of Washington; Kenneth J. Turnbull, instructor in forest mensuration, School of Forestry, University of Washington; and F. Todd Tremblay, Pacific Northwest regional director, National Plant Food Institute.

Copies of the booklet are available at 50 cents each from Dr. Stanley P. Gessel, School of Forestry, University of Washington, Seattle.

* * *

Leo A. Isaac on Silviculture is a 32-page booklet making available for general distribution six lectures delivered by Mr. Isaac while visiting professor at the Oregon State College School of Forestry in 1959. The lectures were titled: 1. "Notes on Silviculture and Ecology of Douglas-fir," 2. "Silvicultural Aspects of Species Growing with Douglas-fir," 3. "Notes on Ecology and Silviculture of Ponderosa Pine," 4. "Tree Improvement in Forestry," 5. "European Forestry," and 6. "Turkey—Its Forests and People."

The author needs no introduction to American foresters. Copies of the booklet may be secured from the School of Forestry, Oregon State College, Corvallis, Ore. No price is indicated.

Symposium of Section O (Agriculture)—AAAS

Land-Zoning in Relation to Agricultural, Suburban, Industrial, Forest, and Recreational Needs of the Future to be held at the Bilmore Hotel, New York City, December 27-30, 1960

Tuesday Morning, December 27

Rural Land Zoning

Chairman: Wallace D. Bowman, The Conservation Foundation.

1. "Misuse of Land—A National Disgrace." Donald A. Williams, Soil Conservation Service.
2. "Principles of Rural Land Zoning." Erling D. Solberg, Agricultural Research Service.
3. Creating Permanent Agricultural Reserves." Karl J. Belser, Santa Clara County Planning Department, San Jose, Calif.
4. "Tax Deferrals for Land Withheld from Development." T. W. Schulenberg, State of Indiana, Department of Commerce and Public Relations.

Tuesday Afternoon, December 27

Suburban Planning

Chairman: Louis Wolfanger, Michigan State University.

1. "Subdivision Control." Hugh R. Pomeroy. Westchester County Department of Planning, White Plains, N. Y.
2. "Soil-Survey Information for Suburban Development." Lindo J. Bartelli, Soil Conservation Service.
3. "New Concepts on Suburban Development Districts." Marion Clawson, Resources for the Future, Inc.
4. "Regulating Flood-Plain Development." Gilbert F. White and Robert Kates, Department of Geography, University of Chicago.

Thursday Morning, December 29

Community Planning

Chairman: Byron E. Munson, Ohio State University.

1. "Small-City Community Planning." Herbert H. Smith, Community Planning Associates, Trenton, N. J.
2. "County and Regional Planning Board Cooperation." George H. Deming, Conference on Metropolitan Area Problems, New York City.
3. "Possibilities in Rural Planning." Sanford S. Farness, Tri-County Regional Planning Commission, Lansing, Mich.
4. "Geologic Contributions to Community Planning." William J. Wayne, Department of Conservation, Geological Survey, State of Indiana.

Thursday Afternoon, December 29

Forest and Recreational Planning

Chairman: Edward Higbee, University of Delaware.

1. "Biological Requirements of Man." Paul B. Sears, Conservation Program, Yale University.
2. "Conservation of Open Spaces." Charles W. Eliot, Landscape Architect-Planning Consultant, Cambridge, Mass.
3. "Program Planning and Legislation for Recreation." Edward C. Crafts, U. S. Forest Service.
4. "Development of Water and Forest Preserves." Raleigh Barlowe, Michigan State University.

Friday Morning, December 30

Government as Land Owner and Redistributor

Chairman: William Miller, New York University.

1. "Public Powers and Controls as Related to Land Use." Roscoe Martin, Syracuse University.
2. "Law of the Open Spaces." Shirley Adelson Siegel, Assistant Attorney General, State of New York.
3. "British Town and County Planning Act." Ernest Weissman, Bureau of Social Affairs, United Nations.
4. "Governmental Assistance in Area Development." Robert E. Lowry, Tennessee Valley Authority.

Current Literature

Compiled by LOIS MCALLISTER, *Assistant Librarian, State University College of Forestry at Syracuse University*
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William L. Hall (1873-1960)

William Logan Hall, 87, Charter Member, past President, and Fellow of the Society of American Foresters, died October 2 in Hot Springs, Ark.

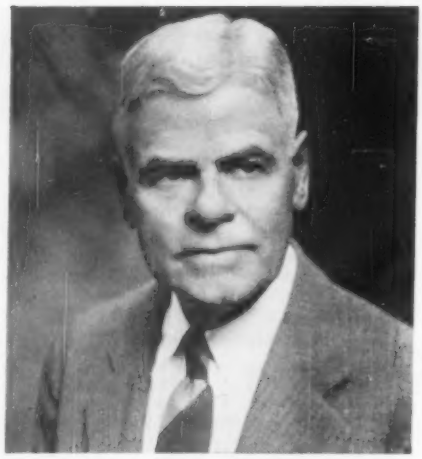
Born May 28, 1873, in Holden, Mo., he studied horticulture and forestry at Kansas State College, receiving the B.S. degree in 1898 and the M.S. degree in 1899.

In the latter year he joined the old Division of Forestry in the U. S. Department of Agriculture, and for several years was in charge of forest planting. Following a forest survey which he made in the Hawaiian Islands in 1903, he was put in charge of the Branch of Forest Products in the U. S. Forest Service, service during the period 1905-1911. He was one of the group that was influential in securing the establishment in 1910 of the Forest Products Laboratory at Madison, Wis.

Enactment in 1911 of the Weeks Law, which provided for the acquisition of national forests in the East, brought about the most important assignment thus far in his career. Following surveys which he made in the White Mountains in New Hampshire and in the southern Appalachians to determine the suitability of lands for national forests, he was appointed the first district (now regional) forester of the eastern United States.

During World War I he served in the Army Corps of Engineers with the rank of major. Returning to the Forest Service in 1919 he worked on plans for a national forestry program that culminated in the Clarke-McNary Act.

Resigning from the Forest Service later in 1919, he organized Hall, Kellogg and Company, a consulting forestry company; and later started a reforestation program for Shevlin-Hixon Company at Bend, Ore. During 1923-1924 he was in the service of Baker, Fentress and Company in Chicago on sales of timber properties.



WILLIAM LOGAN HALL

Starting in 1925 he set up his own business as a consulting forester at Hot Springs serving 12 large lumber and pulp companies in the South and West. From 1928 onward he spent much of his professional career building up a timber property in Arkansas, meanwhile continuing his consulting business.

On the date of his death, Mr. Hall was one of two surviving Charter Members of the Society of American Foresters. (The other is Ralph S. Hosmer of Ithaca, N. Y.) Few members have given as generously of their time and talents to the Society. He served as treasurer during the period 1903-1907; and was president in 1913. He was a member of the Council in 1918 and 1919. In recognition of his outstanding service to forestry and to the Society he was elected a Fellow in 1939. At the annual meeting of the Society held in Milwaukee in 1954, Mr. Hall was presented with the Gifford Pinchot medal, the third time the medal had been awarded.

In the citation, President E. L. Demmon said of the presentation that it was being made "to one of our profession's most respected and beloved practitioners, a forester who was one of the seven founding members of the Society when it was organized in Mr. Pinchot's office in November 1900, and who is still, fifty-four years later, actively practicing forestry on his woodlands in Arkansas."

"Today," continued the citation, "William L. Hall is one of our profession's most loyal adherents to the private enterprise system and to the proposition that forestry can be a profitable commercial enterprise. In successfully applying the profit motive to private forest management, his career has been an encouragement to many younger foresters for it has been characterized by high ethical business principles and professional conduct."

President Demmon concluded, "I am sure that if the great G.P. in whose name this award is made could be with us tonight, he would be delighted to know that the recipient is his old friend and loyal lieutenant Billy Hall."

With William L. Hall's passing, the profession has lost another pioneer. Forester and gentleman, he was an inspiration to all who knew him.

H. C.

Society of American Foresters Natural Areas

During the 13 years of its existence the Committee on Natural Areas has published two lists of approved natural areas. The first list appeared in the February 1949 JOURNAL OF FORESTRY (Vol. 47, No. 2) and the second list in the May 1954 JOURNAL (Vol. 52, No. 5). There follows the Committee's third list of natural areas which includes all areas approved as of January 1, 1960.

In this latest listing the Committee has endeavored to furnish certain additional information beyond that of identification as to location, the administrating agency, and types represented.

First, the number of approved natural areas by states is shown on an outline map of the United States.

Second, the listing of natural areas is by states alphabetically.

Third, the information shown for most of the listed natural areas includes:

a. Average age of each forest type.
b. Average height and diameter of the principal species within each type.
c. The elevation, both low and high, and topography and the geology of each area.

One hundred and twenty-eight natural areas, found within 34 states and Puerto Rico, are listed. Of the 106 forest cover types recognized by the Society for eastern North America 47 types are found within the natural area system. In the west 36 forest cover types out of the 50 types recognized are listed as being within the natural areas.

The Committee recognized from its inception that many of the forest cover types recognized by the Society are transitional or temporary. It was cognizant of the emphasis on major types included in the Society's approved definition of a natural area. However, the Committee in its first report stated that regardless of whether the forest types were considered long- or short-lived, temporary or climax, an endeavor would be made to include all recognized forest types within the natural area system. Accordingly, within the present list will be found forest cover types which cannot be considered "a representative unit of the virgin growth of a major forest type." However, these areas were approved by the Committee for listing on the basis that they are representative of forest growth which may be considered old or mature although not virgin.

Full data were not available for all natural areas listed. The Committee would request all administering agencies concerned to complete the requested data and to make it available as soon as convenient. Specially the record is incomplete with respect to average age of forest types and to average height and diameter of principal species.

The Committee expresses its appreciation to all that have assisted in

FIG. 1.—Number of SAF Natural Areas by states.

providing the facts for this compilation. Further, it will appreciate the assistance of all who may be able to report on additional natural areas. As much as possible of the following information should be furnished to the Committee on any proposed new areas:

a. Name of natural area.
b. Location—state, county, nearest town, and nearest highway.
c. Number of acres and the average age of each SAF type represented.
d. Average height and average d.b.h. of each principal species.
e. High and low elevation of the area.
f. Topography and geology of the area.
g. Policy for reserving the area in a natural condition.
h. Name of agency, name of specific administration unit, name of officer in charge and local address.

JOHN F. SHANKLIN,
Committee on Natural Areas,
Society of American Foresters

Abbreviations

A	Acres	ht.	height	Ref. Mgr.	Refuge Manager
aver.	average	N. A.	Natural Area	S. F.	State Forest
Co.	County	N. F.	National Forest	S. Hwy.	State Highway
dia.	diameter	N. M.	National Monument	S. P.	State Park
F. Hwy.	Federal Highway	N. P.	National Park	Supt.	Superintendent
For. Sup.	Forest Supervisor	N. W. R.	National Wildlife Refuge		

Alaska

Pack Creek N. A.

Located within the North Tongass N. F. near the town of Juneau

SAF Type 223, Sitka spruce, aver. age 200 yrs.	589A
SAF Type 224, Western hemlock, aver. age 200 yrs.	936
SAF Type 225, Sitka spruce-western hemlock, aver. age 200 yrs	1150
Barren, water	3104
Total	5779A

Sitka spruce aver. ht. 100′; aver. dia. 20″
Western hemlock aver. ht. 80′; aver. dia. 18″
Elevation: Low—sea level; High—2500′
Topography: Rolling to steep
Geology: Moraine and alluvial
Mail Address: For. Sup., Juneau, Alaska, Subport

Old Tom Creek N. A.

Located within the South Tongass N. F. near Ketchikan

SAF Type 224, Western hemlock, aver. age 200 yrs.	1420A
SAF Type 225, Sitka spruce-western hemlock, aver. age 200 yrs.	1793
SAF Type 228, Western redcedar, aver. age 200 yrs.	920
Barren, water	594
Total	4727A

Western hemlock aver. ht. 110′; aver. dia. 22″
Sitka spruce aver. ht. 100′; aver. dia. 20″
Western redcedar aver. ht. 120′; aver. dia. 28″
Elevation: Low—sea level; High—1500′
Topography: Rolling to steep
Geology: Moraine
Mail Address: For. Sup., Box 2278, Ketchikan, Alaska

Limestone Inlet N. A.

Located within the North Tongass N. F. near the town of Juneau.

SAF Type 223, Sitka spruce, aver. age 200 yrs.	392A
SAF Type 224, Western hemlock, aver. age 200 yrs.	703
SAF Type 225, Sitka spruce-western hemlock, aver. age 200 yrs.	2205
Barren, water	3139
Total	6439A

Sitka spruce aver. ht. 100′; aver. dia. 20″
Western hemlock aver. ht. 80′; aver. dia. 18″
Elevation: Low—sea level; High—3200′
Topography: Rolling to steep
Geology: Volcanic
Mail Address: For. Sup., Juneau, Alaska, Subport

Halibut Cove N. A.

Located on public domain near the Sterling Hwy and the town of Homer.

SAF Type 222, Black cottonwood—willow, aver. age 90 yrs.	15A
SAF Type 223, Sitka spruce, aver. age 250 yrs.	95
Barren	10
Total	120A

Sitka spruce aver. ht. 82′; aver. dia. 18″
Cottonwood aver. ht. 60′; aver. dia. 12″
Elevation: Low—sea level; High—400′
Topography: Broken
Geology: Volanic (has been glaciated)
Mail Address: Area Operations Supervisor, Bureau of Land Management, 334 East Fifth Avenue, Anchorage, Alaska

Goat Creek N. A.

Located on public domain near the Edgerton Hwy and the town of McCarthy.

SAF Type 201, White spruce, aver. age 190 yrs.	240A

White spruce aver. ht. 58′; aver. dia. 9″
Elevation: Low—1600′; High—1900′
Topography: Glacial erratic in center of flood plain
Geology: Volcanic (has been glaciated)
Mail Address: Area Operations Supervisor, Bureau of Land Management, 334 Fifth Avenue, Anchorage, Alaska

Arizona

Oak Creek Canyon N. A.

Located within the Coconino N. F. near S. Hwy 89A and town of Sedona in Coconino Co.

SAF Type 237 Interior ponderosa pine, aver. age 250 yrs.	940A

Ponderosa pine aver. ht. 65′; aver. dia. 25″
Elevation: Low—5,000′; High—6,500′
Topography: Variable as to altitude, slope, exposure and gradient
Geology: Sedimentary
Mail Address: For. Sup., Box 1490, Flagstaff, Arizona

Walnut Canyon N. A.

Located within Walnut Canyon N. M. off S. Hwy 177 and near Flagstaff in Coconino Co.

SAF Type 237 Interior ponderosa pine, aver. age 200 yrs.	160A
SAF Type 239 Pinyon-juniper, aver. age 200 yrs.	100
Total	260A

Ponderosa pine aver. ht. 70′; aver. dia. 20″
Pinyon pine aver. ht. 30′; aver. dia. 12″
Elevation: Low—6,200′; High—6,710′
Topography: Level cut with small side canyons
Geology: Alluvial
Mail Address: Supt., Route 1, Box 790, Flagstaff, Arizona

San Francisco Peaks N. A.

Located within the Coconino N. F. near Co. road (Forest #517) and town of Flagstaff in Coconino Co.

SAF Type 206 Engelmann spruce-subalpine fir, aver. age 150 yrs.	953A

Corkbark fir aver. ht. 25′; aver. dia. 15″
Engelmann spruce aver. ht. 50′; aver. dia. 22″
Elevation: Low—9,000′; High—11,500′
Topography: Steep
Geology: Volcanic
Mail Address: For. Sup., Box 1490, Flagstaff, Arizona

Santa Catalina N. A.

Located within the Coronado N. F. near U. S. Hwy 80 and 89 and town of Tucson in Pima Co.

SAF Type 206 Engelmann spruce-subalpine fir, aver. age 200 yrs.	300A
SAF Type 235 Cottonwood-willow, aver. age 50 yrs.	200
SAF Type 237 Interior ponderosa pine, aver. age 200 yrs.	2350
SAF 241 Interior live oak, aver. age 50 yrs.	1614
Total	4464A

Arizona pine aver. ht. 45′; aver. dia. 18″
Douglas-fir aver. ht. 80′; aver. dia. 30″
White fir aver. ht. 80′; aver. dia. 25″
Elevation: Low—4,800′; High—9,100′
Topography: Extremely rough and precipitous
Geology: Granitic
Mail Address: For. Sup., Box 551, Tucson, Arizona

Chiricahua N. A.

Located within Chiricahua N. M. near S. Hwy 181 and town of Dos Cabezas in Cochise Co.

SAF Type 210, Interior Douglas-fir, mature	100A
SAF Type 237, Interior ponderosa pine, mature	80
SAF Type 239, Pinyon-juniper, mature	320
SAF Type 240, Arizona cypress, mature	40
SAF Type 241, Interior live oak, mature	160
Total	700A

Arizona cypress aver. ht. 60′; aver. dia. 1.5′
Chihuahua pine aver. ht. 50′; aver. dia. 1′
Elevation: Low—5,200′; High—7,308′
Topography: Broken, rocky, mountainous
Geology: Volcanic
Mail Address: Supt., Dos Cabezas, Arizona

Great Thumb N. A.

Located within Grand Canyon N. P. near S. Hwy 64 and town of Grand Canyon in Coconino Co.

SAF Type 239, Pinyon-juniper, aver. age 70 yrs.	930A

Pinyon pine aver. ht. 20′; aver. dia. 12″
Elevation: Low—6,100′; High—6,185′
Topography: Level
Geology: Paleozoic sediments
Mail Address: Supt., Grand Canyon, Arizona

Neal Springs N. A.

Located within Grand Canyon N. P. near S. Hwy 67 and town of Fredonia in Coconino Co.

SAF Type 217, Aspen, aver. age 40 yrs.	15A

Aspen aver. ht. 30′; aver. dia. 9″
Elevation: Low—7,400′; High—7,650′
Topography: Steep
Geology: Paleozoic sediments
Mail Address: Supt., Grand Canyon, Arizona

Powell Plateau N. A.

Located within Grand Canyon N. P. near S. Hwy 67 and town of Fredonia in Coconino Co.

SAF Type 237, Interior ponderosa pine, aver. age 90 yrs.	5120A

Ponderosa pine aver. ht. 40′; aver. dia. 20″
Elevation: Low—6,750′; High—7,650′
Topography: Level (plateau)
Geology: Paleozoic sediments
Mail Address: Supt., Grand Canyon, Arizona

Swamp Point N. A.

Located within the Grand Canyon N. P. near S. Hwy 67 and the town of Fredonia in Coconino Co.

SAF Type 237, Interior ponderosa pine, aver. age 85 yrs.	1920A

Ponderosa pine aver. ht. 36′; aver. dia. 18″
Elevation: Low—7,750′; High—7,847′
Topography: Level
Geology: Paleozoic sediments
Mail Address: Supt., Grand Canyon, Arizona

Wayside N. A.

Located within the Grand Canyon N. P. near S. Hwy 64 and the town of Grand Canyon in Coconino Co.

SAF Type 239, Pinyon-juniper, aver. age 75 yrs.	480A

Pinyon pine aver. ht. 25′; aver. dia. 14″
Elevation: Low—6,800′; High—7,250′
Topography: Rolling
Geology: Paleozoic sediments
Mail Address: Supt., Grand Canyon, Arizona

Mount Emma N. A.

Located within the Grand Canyon N.P. near Fed. Hwy 89 and the town of Fredonia in Mohave Co.

SAF Type 237, Interior ponderosa pine, aver. age 85 yrs.	1150A

Ponderosa pine aver. ht. 38′; aver. dia. 18″
Elevation: Low—6,750′; High—7,500′
Topography: Steep
Geology: Volcanic quaternary
Mail Address: Supt., Grand Canyon, Arizona

Butterfly Peak N. A.

Located within the Coronado N.F. near Fed. Hwy 80 and 89 and the town of Tucson in Pima Co.

SAF Type 237, Interior ponderosa pine, aver. age 200 yrs.	560A
SAF Type 241, Interior live oak, aver. age 50 yrs.	200
SAF Type 241, Interior live oak, (burned) aver. age 10 yrs.	240
Total	1000A

Arizona pine aver. ht. 50′; aver. dia. 22″
Douglas-fir aver. ht. 70′; aver. dia. 28″
White fir aver. ht. 70′; aver. dia. 25″
Elevation: Low—5,200′; High—7,000′
Topography: Steep and broken
Geology: Granitic
Mail Address: For. Sup., Box 551, Tucson, Arizona

G. A. Pearson N. A.

Located within the Fort Valley Experimental Forest near Fort Valley Road and the town of Flagstaff in Coconino Co.

SAF Type 237, Interior ponderosa pine, aver. age 250 yrs.*	84A
SAF Type 237, Interior ponderosa pine, aver. age 50 yrs.	66
Total	150A

*Ponderosa pine aver. ht. 100′; aver. dia. 23″
Elevation: Low—7,325′; High—7,450′
Topography: Level to rolling
Geology: Volcanic
Mail Address: Research Center Leader, Fort Valley Experimental Forest, Rocky Mountain Forest and Range Experiment Station, Arizona State College, Flagstaff, Arizona

Pole Bridge Canyon N. A.

Located within the Coronado N. F. near S. Hwy 181 and the town of Pearce in Cochise Co.

SAF Type 237, Interior ponderosa pine, aver. age 125 yrs.	230A
SAF Type 239, Pinyon-juniper, aver. age 50 yrs.	90
Total	320A

Arizona pine aver. ht. 80′; aver. dia. 24″
Mexican pinyon aver. ht. 20′; aver. dia. 14″
Apache pine aver. ht. 80′; aver. dia. 20″
Chihuahua pine aver. ht. 40′; aver. dia. 15″
Elevation: Low—7,000′; High—7,800′
Topography: Steep and broken
Geology: Alluvial of volcanic origin
Mail Address: For. Sup., P.O. Box 551, Tucson, Arizona

Arkansas

Big Lake N. A.

Located within the Big Lake N.W.R. near S. Hwy 77 and the town of Manila in Mississippi Co.

SAF Type 101, Baldcypress, aver. age 75 yrs.	500A

Baldcypress aver. ht. 100′; aver. dia. 24″
Elevation: Low—233′; High—236′
Topography: Level
Geology: Alluvial
Mail Address: Ref. Mgr., Box 65, Manila, Arkansas

White River N. A.

Located within the White River N.W.R. near S. Hwy 85 and the town of Snow Lake in Desha Co.

SAF Type 92, Sweetgum-Nuttall oak-willow oak, aver. age 200 yrs.	410A
SAF Type 93, Sugarberry-American elm-green ash, aver. age 80 yrs.	109
SAF Type 96, Overcup oak-water hickory, aver. age 190 yrs.	454
Total	973A

Overcup oak aver. ht. 90′; aver. dia. 23″
Bitter pecan aver. ht. 100′; aver. dia. 22″
Nuttall oak aver. ht. 100′ aver. dia. 34″
Hackberry aver. ht. 80′; aver. dia. 15″
Sweet pecan aver. ht. 110′; aver. dia. 29″
Elevation: Low—130′; High—150′
Topography: Level
Geology: Alluvial
Mail Address: Ref. Mgr., P.O. Box 187, St. Charles, Arkansas

California

White Mountain N. A.

Located within the Inyo N. F. near S. Hwy 3 and the town of Bishop in Mono Co.
SAF Type 209, Bristlecone pine, aver. age 900 yrs. 1500A
Bristlecone pine aver. ht. 50′; aver. dia. 24″
Elevation: Low—9,900′; High—11,419′
Topography: Steep to broken
Geology: Volcanic and broken sedimentary
Mail Address: For. Sup., Bishop, California

San Joaquin Exp. Range N. A.

Located within the San Joaquin Exp. Range near S. Hwy 41 and the town of Coarsegold in Madera Co.
SAF Type 250, Digger pine-oak, aver. age 45 yrs. 70A
Digger pine aver. ht. 35′; aver. dia. 12″
*Oak aver. ht. 20′; aver. dia. 10″
Elevation: Low—1,065′; High—1,200′
Topography: Rolling
Geology: Granitic
Mail Address: Director, Pacific Southwest Forest and Range Exp. Station, P.O. Box 245, Berkeley, Calif.
*Probably canyon live oak and California white oak

Harvey Monroe Hall N. A.

Located within the Inyo N.F. near S. Hwy 120 and the town of Lee Vining in Mono Co.

SAF Type 208, Whitebark pine	650A
SAF Type 218, Lodgepole pine	1100
Barren	2500
Total	4250A

Lodgepole pine aver. ht. 20′; aver. dia. 10″
Whitebark pine aver. ht. 50′; aver. dia. 16″
Elevation: Low—9,000′; High—12,596′
Topography: Steep and broken
Geology: Glacial
Mail Address: For. Sup., Bishop, California

Indiana Summit N. A.

Located within the Inyo N.F. near S. Hwy 395 and the town of June Lake in Mono Co.

SAF Type 218, Lodgepole pine, aver. age 100 yrs.	126A
SAF Type 247, Jeffrey pine, aver. age 200 yrs.	1800
Total	1926A

Jeffrey pine aver. ht. 100′; aver. dia. 24″
Lodgepole pine aver. ht. 60′; aver. dia. 16″
Elevation: Low—7,800′; High—8,500′
Topography: Rolling to steep
Geology: Volcanic
Mail Address: For. Sup., Bishop, California

Devils Garden N. A.

Located within the Modoc N. F. near F. Hwy 395 and the town of Davis Creek in Modoc Co.
SAF Type 238, Western juniper 1600A
Western juniper aver. ht. 20′; aver. dia. 16″
Elevation: Low—4,800′; High—4,850′
Topography: Rolling
Geology: Volcanic
Mail Address: For. Sup., Alturas, California

Telescope Peak N. A.

Located within the Death Valley Nat. Mon. near S. Hwy 190 and the town of Trona in Inyo Co.
SAF Type 239, Pinyon-juniper 1900A
(some Bristlecone pine present)
Elevation: Low—7,500′; High—11,000′
Topography: Steep
Geology: Gneiss, schist and granite
Mail Address: Supt., Death Valley, California

Heather Lake N. A.

Located within the Sequoia N. P. near Generals Hwy and the town of Three Rivers in Tulare Co.
SAF Type 215, Western white pine 40A
Elevation: Low—9,500′; High—10,000′
Topography: Broken
Geology: Glaciated granite
Mail Address: Supt., Three Rivers, California

Red Spur N. A.

Located within Sequoia N. P. near S. Hwy 395 and the town of Lone Pine in Tulare Co.
SAF Type 208, Whitebark pine 2000A
Elevation: Low—10,000′ ;High—12,000′
Topography: Varying from level to steep and broken
Geology: Glaciated granite
Mail Address: Supt., Three Rivers, California

Whitney Creek N. A.

Located within Sequoia N. P. near S. Hwy 395 and the town of Lone Pine in Tulare Co.
SAF Type 219, Limber pine 75A
Elevation: Low—8,500′; High—10,500′
Topography: Rolling to broken
Geology: Glaciated granite
Mail Address: Supt., Three Rivers, California

Merced River N. A.

Located within Yosemite N. P. near S. Hwy 140 and the town of Mariposa in Mariposa Co.
SAF Type 249, Canyon live oak 600A
Elevation: Low—2,500′; High—4,500′
Topography: Very steep
Geology: Granite
Mail Address: Supt., P.O. Box 577, Yosemite Nat. Park, Calif.

Tamarack Creek N. A.

Located within Yosemite N. P. near S. Hwy 120 and the town of Groveland in Mariposa Co.
SAF Type 207, Red fir 640A
Elevation: Low—6,800′; High—7,900′
Topography: Steep
Geology: Granite
Mail Address: Supt., P.O. Box 577, Yosemite Nat. Park, Calif.

Carl Inn N. A.

Located within Yosemite N. P. near S. Hwy 120 and the town of Groveland in Tuolumne Co.
SAF Type 243, Ponderosa pine-sugar pine-fir 488A
Elevation: Low—5,400′; High—5,700′
Topography: Rolling
Geology: Granite
Mail Address: Supt., P.O. Box 577, Yosemite Nat. Park, Calif.

Colorado

Narraguinnep N. A.

Located within San Juan N.F. near For. Serv. Road 2504, and the town of Dolores in Dolores Co.

SAF Type 217, Aspen, aver. age 30 yrs.	114A
SAF Type 237, Interior ponderosa pine, aver. age 120 yrs.	891
SAF Type 239, Pinyon-juniper aver. age 80 yrs.	715
Total	1720A

Ponderosa pine aver. ht. 84′; aver. dia. 24″
Aspen aver. ht. 30′; aver. dia. 6″
Elevation: Low—7,000′; High—7,700′
Topography: Steep, rocky canyon
Geology: Sandstone
Mail Address: For. Sup., Durango, Colorado

Gothic N. A.

Located within Gunnison N. F. near S. Hwy 135, and the town of Crested Butte in Gunnison Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 120 yrs.	531A
Grass, barren	519
Total	1050A

Engelmann spruce aver. ht. 100′; aver. dia. 30″
Subalpine fir aver. ht. 100′; aver. dia. 30″
Elevation: Low—10,000′; High—12,000′
Topography: Steep and broken
Geology: Igneous
Mail Address: For. Sup., Gunnison, Colorado

Park Mesa N. A.

Located within the Mesa Verde N. P. near F. Hwy 160 and the town of Cortez in Montezuma Co.

SAF Type 239, Pinyon-juniper, aver. age 250 yrs.	1500A

Pinyon pine aver. ht. 15′; aver. dia. 10″
Utah juniper aver. ht. 14′; aver. dia. 12″
Elevation: Low—6,900′; High—8,300′
Topography: Broken
Geology: Alluvial
Mail Address: Supt., Mesa Verde N.P., Colorado

Hurricane Canyon N. A.

Located within the Pike N. F. near F. Hwy 24 and the town of Manitou Springs in El Paso Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 150 yrs.	30A
SAF Type 210, Interior Douglas-fir, aver. age 200 yrs.	354
SAF Type 237, Interior ponderosa pine, aver. age 200 yrs.	101
Brush and barren	35
Total	520A

Engelmann spruce aver. ht. 50′ aver. dia. 21″
Subalpine fir aver. ht. 38′; aver. dia. 10″
Ponderosa pine aver. ht. 40′; aver. dia. 18″
Elevation: Low—7,500′; High—9,000′
Topography: Steep boulder filled canyon
Geology: Granite, oxidizing
Mail Address: For. Sup., Colorado Springs, Colorado

Saddle Mountain N. A.

Located within the Pike N. F. near S. Hwy 299 and the town of Guffey in Park Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 150 yrs.	280A
SAF Type 217, Aspen, aver. age 50 yrs.	110
Non-forested	110
Total	500A

Engelmann spruce aver. ht. 45′; aver. dia. 14″
Subalpine fir aver. ht. 35′; aver. dia. 9″
Aspen aver. ht. 30′; aver. dia. 10″
Elevation: Low—9,100′; High—10,000′
Topography: Half of area steep, other half rolling
Geology: Volcanic lavas—andacite
Mail Address: For. Sup., Colorado Springs, Colorado

Goliath N. A.

Located within the Arapaho N.F. near F. Hwy 6 and 40 and the town of Idaho Springs in Jefferson Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 250 yrs.	60A
SAF Type 209, Bristlecone pine, aver. age 500 yrs.	60
Alpine tundra	40
Total	160A

Engelmann spruce aver. ht. 36′; aver. dia. 12″
Bristlecone pine aver. ht. 24′; aver. dia. 12″
Elevation: Low—11,300′; High—12,100′
Topography: Moderately steep
Geology: Volcanic
Mail Address: For. Sup., Golden, Colorado

Florida

St. Marks N. A.

Located within the St. Marks N.W.R. near S. Hwy 59 and the town of Newport in Wakulla Co.

SAF Type 84, Slash pine, aver. age 20 yrs.*	300A
SAF Type 86, Cabbage palmetto-slash pine, aver. age 20 yrs.*	100
Total	400A

*A few very old (probably 80 yrs.) slash pines
Slash pine aver. ht. 38′; aver. dia. 5″
Cabbage palmetto aver. ht. 15′ aver. dia. 8″
Elevation: Low—3′; High—5′
Topography: Level
Geology: Alluvial
Mail Address: Refuge Manager, P.O. Box 67, St. Marks, Florida

Osceola N. A.

Located within the Osceola N. F. near S. Hwy 250 and the town of Olustee in Baker Co.

SAF Type 70, Longleaf pine, aver. age 60 yrs.	32A
SAF Type 84, Slash pine, aver. age 40 yrs.	44
SAF Type 86, Cabbage palmetto-slash pine, aver. age 60 yrs.	95
SAF Type 98, Pond pine, aver. age 50 yrs.	7
SAF Type 100, Pondcypress, aver. age 250 yrs.	64
SAF Type 104, Sweetbay-swamp tupelo-red maple, aver. age 150 yrs.	131
Total	373A

Longleaf pine aver. ht. 70′; aver. dia. 15″
Slash pine aver. ht. 80′; aver. dia. 20″
Pond pine aver. ht. 80′; aver. dia. 16″
Cypress aver. ht. 80′; aver. dia. 36″
Hardwoods aver. ht. 80′; aver. dia. 42″
Elevation: Low—10′; High—10′
Topography: Level
Geology: Alluvial
Mail Address: For. Sup., P.O. Box 1050, Tallahassee, Florida

Corkscrew Swamp Sanctuary N. A.

Located near U. S. Hwy 41, State Hwy 846 and the town of Immokalee in Collier Co.

SAF Type 84, Slash pine, aver. age 100 yrs.	1120A
SAF Type 100, Pondcypress, aver. age 150 yrs.	3250
SAF Type 101, Baldcypress, aver. age 350 yrs.	600
Sawgrass Marsh	1050
Total	6020A

Baldcypress aver. ht. 100′; aver. dia. 30″
Pondcypress aver. ht. 50′; aver. dia. 12″
Slash pine aver. ht. 65′; aver. dia. 14″
Elevation: Low—15′; High—20′
Topography: Level
Geology: Deposits of Recent and Pamlico sands overlying marl or limestone
Mail Address: National Audubon Society, c/o Corkscrew Swamp Sanctuary, Box 806, Immokalee, Florida

Georgia

Piedmont N. A.

Located within the Piedmont N.W.R. near S. Hwy 11 and the town of Wayside in Jones Co.

SAF Type 80, Loblolly pine-shortleaf pine, aver. age 40 yrs.	118A

Loblolly pine aver. ht. 80′; aver. dia. 13″
Shortleaf pine aver. ht. 80′; aver. dia. 11″
Elevation: Low—475′; High—595′
Topography: Rolling
Geology: Alluvial
Mail Address: Refuge Manager, Round Oak, Georgia

Okefenokee No. 1 N. A.

Located within the Okefenokee N.W.R. near F. Hwys 1 and 23 and town of Waycross in Charlton Co.

SAF Type 100, Pondcypress, aver. age 250 yrs.	14,989A

Pondcypress aver. ht. 60′; aver. dia. 12″
Elevation: Low—120′; High—120′
Topography: Level
Geology: Peat deposit
Mail Address: Refuge Manager, Box 117, Waycross, Georgia

Okefenokee No. 2 N. A.

Located within the Okefenokee N.W.R. near F. Hwys 1 and 23 and town of Waycross in Ware and Clinch Cos.

SAF Type 104, Sweetbay—swamp tupelo—red maple, aver. age 60 yrs. 2,560A
Elevation: Low—120′; High—120′
Topography: Level
Geology: Peat deposit
Mail Address: Refuge Manager, Box 117, Waycross, Georgia

Blackbeard Island N. A.

Located within the Blackbeard Island N.W.R. near F. Hwy 17 and the town of Townsend in McIntosh Co.
SAF Type 85, Slash pine—hardwood, aver. age 100 yrs. 450A
Slash pine aver. ht. 80′; aver. dia. 24″
Hardwood aver. ht. 50′; aver. dia. 15″
Elevation: Low—sea level; High—20′
Topography: Low sand ridges parallel to coast with alternating sloughs
Geology: Barrier beach island
Mail Address: Refuge Manager, Shellmans Bluff, Townsend, Georgia

Idaho

Teepee Creek N. A.

Located within the Kaniksu N. F. near the town of Priest River in Bonner Co.
SAF Type 215, Western white pine, aver. age 200 yrs. 441A
SAF Type 215, Western white pine, aver. age 60 yrs. 305
Total 746A
Western white pine aver. ht. 130′; aver. dia. 22″
Western hemlock aver. ht. 100′; aver. dia. 22″
Western redcedar aver. ht. 100′; aver. dia. 27″
Elevation: Low—2450′; High—3200′
Topography: Rolling
Geology: Deep sandy loam overlying schistose rocks of the Idaho batholith
Mail Address: For. Sup., Sandpoint, Idaho

Monteford Creek N. A.

Located within the Coeur D'Alene N. F. in Kootenai Co.
SAF Type 212, Larch—Douglas-fir 6A
SAF Type 215, Western white pine 299
SAF Type 218, Lodgepole pine 1
SAF Type 224, Western hemlock 29
Total 335A
Mail Address: For. Sup., Coeur D'Alene, Idaho

Canyon Creek N. A.

Located within the Kaniksu N. F. near the town of Granite in Bonner Co.
SAF Type 206, Engelmann spruce-subalpine fir 379A
SAF Type 208, Whitebark pine 50
SAF Type 210, Interior Douglas-fir 14
SAF Type 212, Larch—Douglas-fir 12
SAF Type 215, Western white pine 313
SAF Type 218, Lodgepole pine 47
SAF Type 224, Western hemlock 129
SAF Type 228, Western redcedar 9
Non-forested 81
Total 1034
Elevation: Approx. 3500′
Mail Address: For. Sup., Sandpoint, Idaho

Indiana

Pioneer Mother's Memorial Forest N. A.

Located within the Pioneer Mother's Memorial Forest near F. Hwy 150 and S. Hwy 37 and the town of Paoli in Orange Co.
SAF Type 59, Yellow-poplar-white oak-Northern red oak, aver. age 250 yrs. 62A
SAF Type 60, Beech-sugar maple, aver. age 250 yrs. 26
Total 88A
Oaks aver. ht. 100′; aver. dia. 40″
Black walnut aver. ht. 90′; aver. dia. 36″
Yellow-poplar aver. ht. 110′; aver. dia. 38″
Beech aver. ht. 90′; aver. dia. 42″
Elevation: Low—550′; High—600′
Topography: Rolling
Geology: Residual
Mail Address: District Ranger, Tell City, Indiana

Kentucky

Rock Creek N. A.

Located within the Cumberland N. F. near S. Hwy 192 and the town of Corbin in Laurel Co.
SAF Type 23, Hemlock, aver. age 150 yrs. 176A
SAF Type 75, Shortleaf pine, aver. age 80 yrs. 11
SAF Type 76, Shortleaf pine-oak, aver. age 80 yrs. 3
Total 190A
Eastern hemlock aver. ht. 90′; aver. dia. 16″
Yellow-poplar aver. ht. 90′; aver. dia. 18″
Elevation: Low—850′; High—900′
Topography: Broken with rock cliffs
Geology: Alluvial plain below sandstone cliffs
Mail Address: For. Sup., P.O. Box 56, Winchester, Kentucky

Kentucky Woodlands No. 1 N. A.

Located within the Kentucky Woodlands N.W.R. near S. Hwy 289 and the town of Golden Pond in Trigg and Lyon Co.
SAF Type 40, Post oak-black oak, aver. age 70 yrs. 25A
SAF Type 52, White oak-red oak-hickory, aver. age 70 yrs. 215
Total 240A
White oak aver. ht. 60′; aver. dia. 12″
Black oak aver. ht. 48′; aver. dia. 9″
Hickory aver. ht. 33′; aver. dia. 7″
Elevation: Low—380′; High—480′
Topography: Rolling
Geology: Alluvial (Tuscaloosa gravel)
Mail Address: Ref. Mgr., Route 2, Golden Pond, Kentucky

Kentucky Woodlands No. 2 N. A.

Located within the Kentucky Woodlands N.W.R. near S. Hwy 453 and town of Golden Pond in Trigg Co.
SAF Type 40, Post oak-black oak, aver. age 89 yrs. 35A
Post oak aver. ht. 50′; aver. dia. 11″
Black oak aver. ht. 50′; aver. dia. 10″
White oak aver. ht. 55′; aver. dia. 13″
Elevation: Low—530′; High—580′
Topography: Rolling
Geology: Alluvial (Tuscaloosa gravel)
Mail Address: Ref. Mgr., Route 2, Golden Pond, Kentucky

Maine

Edmunds N. A.

Located within the Moosehorn N.W.R. near F. Hwy 1 and the town of Dennysville in Washington Co.
SAF Type 33, Red spruce-balsam fir, aver. age 35 yrs. 130A
SAF Type 37, Northern white-cedar, aver. age 40 yrs. 30
Total 160A
Balsam fir aver. ht. 40′; aver. dia. 6″
Northern white-cedar aver. ht. 32′ aver. dia. 7″
Elevation: Low—90′; High—150′
Topography: Rolling
Geology: Glacial till
Mail Address: Ref. Mgr., Calais, Maine

Bald Porcupine N. A.

Located within Acadia N. P. near S. Hwy 3 and the town of Bar Harbor in Hancock Co.
SAF Type 36, White spruce-balsam fir-paper birch, aver. age 70 yrs. 40A
White spruce aver. ht. 30′; aver. dia. 10″
Elevation: Low—sea level; High—186′
Topography: Steep
Geology: Crystalline metamorphosed sedimentary of great age—subsequently glaciated
Mail Address: Supt., Box 690, Bar Harbor, Maine

Eastern Head N. A.

Located within Acadia N. P. near S. Hwy 172 and the town of Stonington in Hancock Co.

SAF Type 36, White spruce-balsam fir-paper birch, aver. age 90 yrs. 140A
White spruce aver. ht. 35′; aver. dia. 10″
Elevation: Low—sea level; High—140′
Topography: Steep shoreline and rolling inland
Geology: Crystalline metamorphosed sedimentary of great age—subsequently glaciated
Mail Address: Supt., Box 690, Bar Harbor, Maine

Baring N. A.

Located within the Moosehorn N. W. R. near Charlotte Road and the town of Calais in Washington Co.
SAF Type 21, White pine, aver. age 65 yrs. 160A
White pine aver. ht. 37′; aver. dia. 8″
Red maple aver. ht. 43′; aver. dia. 5″
Elevation: Low—200′; High—400′
Topography: Rolling
Geology: Glacial till
Mail Address: Ref. Mgr., Calais, Maine

Massachusetts

Barre Woods N. A.

Located within the Harvard Forest near S. Hwy 32 and 122 and the town of Petersham in Worcester Co.

SAF Type 20, White pine—northern red oak—white ash, aver. age 80 yrs.	11A
SAF Type 21, White pine, aver. age 80 yrs.	24
SAF Type 22, White pine—hemlock, aver. age 90 yrs.	21
SAF Type 23, Hemlock, aver. age 80 yrs.	10
SAF Type 25, Sugar maple—beech—yellow birch, aver. age 90 yrs.	57
Mixed and barren	12
Total	135A

Hemlock aver. ht. 75′; aver. dia. 14″
White pine aver. ht. 90′; aver. dia. 24″
Elevation: Low—700′; High—1020′
Topography: Rolling to steep
Geology: Glacial mantle
Mail Address: Director, Harvard Forest, Petersham, Mass.

Michigan

Upper Peninsula N. A.

Located within the Upper Peninsular Experimental Forest near S. Hwy 94 and the town of Marquette in Marquette Co.

SAF Type 23, Hemlock, aver. age 200 yrs.	5A
SAF Type 24, Hemlock-yellow birch, aver. age 200 yrs.	34A
SAF Type 27, Sugar maple, aver. age 150 yrs.	87A
SAF Type 37, Northern white-cedar, aver. age. 200 yrs.	47A
SAF Type 39, Black ash-American elm-red maple, aver. age 150 yrs.	58A
Total	231A

Hardwoods aver. ht. 80′; aver. dia. 16″
Conifers aver. ht. 70′; aver. dia. 14″
Elevation: Low—1,050′; High—1,100′
Topography: Rolling
Geology: Till plain
Mail Address: Dir., Lake States Forest Experiment Station, Marquette, Michigan

Passage Island N. A.

A separate island adjacent to Isle Royale, administered as a part of Isle Royale N. P., located in Keweenaw Co.
SAF Type 5, Balsam fir, aver. age 65 yrs. 104A
Balsam fir aver. ht. 35′; aver. dia. 10″
Elevation: Low—602′; High—800′
Topography: Steep
Geology: Lava flows with interbedded sandstone and conglomerate, subsequently glaciated
Mail Address: Park Supt., 87 N. Ripley Street, Houghton, Mich.

Warren Woods N. A.

Located within Warren Dunes S. P. near the town of Bridgman in Berrien Co.
SAF Type 60, Beech-sugar maple, aver. age 200 yrs. 196A
Beech aver. ht. 105′; aver. dia. 26″
Maple aver. ht. 110′; aver. dia. 29″
Topography: Rolling with a small river cutting diagonally through it
Geology: Alluvial
Mail Address: Park Manager, Warren Dunes S. P. Bridgman, Michigan

Seney N. A.

Located within the Seney N.W.R. near S. Hwy 77 and the town of Seney in Schoolcraft Co.

SAF Type 15, Red pine, aver. age 60 yrs.	100A
SAF Type 22, White pine-hemlock, aver. age 60 yrs.	50
SAF Type 25, Sugar maple-beech-yellow birch, aver. age 55 yrs.	350
Total	500A

All species aver. ht. 60′; aver. dia. 11-14″
Elevation: Low—800′; High—900′
Topography: Level
Geology: Alluvial
Mail Address: Refuge Manager, Seney, Michigan

Minnesota

Keeley Creek N. A.

Located within the Superior N. F. near S. Hwy 1 and the town of Ely in Lake Co.

SAF Type 1, Jack pine, aver age. 85 yrs.	303A
SAF Type 5, Balsam fir, aver. age 75 yrs.	87
SAF Type 12, Black spruce, aver. age 75 yrs.	148
SAF Type 16, Aspen, aver. age 60 yrs.	42
Barren	60
Total	640A

Jack pine aver. ht. 75′; aver. dia. 12″
Spruce aver. ht. 70′; aver. dia. 9″
Balsam fir aver. ht. 70′; aver. dia. 9″
Aspen aver. ht. 70′; aver. dia. 10″
Elevation: Low—1430′; High—1460′
Topography: Rolling to broken
Geology: Glaciated
Mail Address: For. Sup., Box 338, Duluth, Minnesota

Pine Point N. A.

Located within the Chippewa N. F. near S. Hwy 34 and the town of Walker in Cass Co.

SAF Type 1, Jack pine, aver. age 80 yrs.	28A
SAF Type 15, Red pine, aver. age 100 yrs.	550
SAF Type 16, Aspen, aver. age 65 yrs.	95
Meadow	503
Total	1176A

Red pine aver. ht. 90′; aver. dia. 24″
Jack pine aver. ht. 75′; aver. dia. 12″
Elevation: Low—1282′; High—1300′
Topography: Level to rolling
Geology: Moraine
Mail Address: For. Sup., Cass Lake, Minnesota

Rice Lake N. A.

Located within the Rice Lake N. W. R. near S. Hwy 65 and the town of McGregor in Aitkin Co.
SAF Type 38, Tamarack, aver. age 50 yrs. 100A
Tamarack aver. ht. 30′; aver. dia. 6″
Elevation: Low—96′; High—110′
Topography: Rolling
Geology: Moraine
Mail Address: Ref. Mgr., McGregor, Minnesota

Lac LaCroix N. A.

Located within the Superior N. F. near Ely-Buyck Road and the town of Ely in St. Louis Co.

SAF Type 1, Jack pine, aver. age 110 yrs.	28A
SAF Type 5, Balsam fir, aver. age 100 yrs.	80
SAF Type 12, Black spruce, aver. age 110 yrs.	17
SAF Type 15, Red pine, aver. age 140 yrs.	188
SAF Type 16, Aspen, aver. age 70 yrs.	63
SAF Type 21, White pine, aver. age 140 yrs.	386
Swamp, barren	210
Total	973A

Red pine aver. ht. 110′; aver. dia. 20″
White pine aver. ht. 110′; aver. dia. 30″

Balsam fir aver. ht. 75′; aver. dia. 10″
Elevation: Low—1340′; High—1380′
Topography: Rolling to broken
Geology: Glaciated
Mail Address: For. Sup., Box 338, Duluth, Minnesota

Indian Point N. A.

Located within the Rice Lake N. W. R. near S. Hwy 65 and the town of McGregor in Aitkin Co.

SAF Type 26, Sugar maple-basswood, aver. age 100 yrs.	40A
SAF Type 27, Sugar maple, aver. age 100 yrs.	40
Conifer-hardwood mixture	80
Total	160A

Sugar maple aver. ht. 50′; aver. dia. 18″
Basswood aver. ht. 50′; aver. dia. 18″
Elevation: Low—1243′; High—1278′
Topography: Glacial ridge
Geology: Moraine
Mail Address: Ref. Mgr., McGregor, Minnesota

Sunken Lake N. A.

Located within Chippewa N. F. in Itasca Co.

SAF Type 1, Jack pine	77A
SAF Type 12, Black Spruce	13
SAF Type 15, Red pine	156
SAF Type 16, Aspen	70
SAF Type 18, Paper birch	171
SAF Type 37, Northern white cedar	19
Barren	134
Total	640A

Mail Address: For. Sup., Cass Lake, Minnesota

Caldonia Oaks N. A.

Located near town of Caldonia in Houston Co.

SAF Type No. 52, White oak—red oak—hickory Aver. age 150 yrs.	80A

White oak aver. ht. 80′; aver. dia. 30″
Red oak aver. ht. 80′; aver. dia. 30″
Shagbark hickory aver. ht. 75′; aver. dia. 8″
Elevation: Low—800′; High—1,000′
Topography: Steep
Geology: Morainal
Mail Address: Nature Conservancy, 2039 K St., N.W., Washington 6, D. C.

Mississippi

Noxubee N. A.

Located within the Noxubee N. W. R. near Bluff Lake-Louisville Co. Road and the town of Brooksville in Winston Co.

SAF Type 101, Baldcypress, aver. age 100 yrs.	46A

Baldcypress aver. ht. 120′; aver. dia. 20″
Elevation: Low—230′; High—235′
Topography: Level
Geology: Alluvial
Mail Address: Refuge Manager, Brooksville, Mississippi

Red Gum N. A.

Located within the Mississippi National Forests near S. Hwy 16 and the town of Yazoo City in Sharkey Co.

SAF Type 82, Loblolly pine-hardwood, aver. age 250 yrs.	40A

Sweetgum aver. ht. 130′; aver. dia. 36″
Elevation: Low—90′; High—95′
Topography: Level
Geology: Alluvial
Mail Address: For. Sup., P.O. 1291, Jackson, Mississippi

Green Ash N. A.

Located within the Mississippi National Forests near S. Hwy 16 and the town of Yazoo City in Sharkey Co.

SAF Type 93, Sugarberry-American elm-green ash, aver. age 200 yrs.	80A

Green ash aver. ht. 110′; aver. dia. 24″
Elevation: Low—85′; High—90′
Topography: Level
Geology: Alluvial
Mail Address: For. Sup., P.O. Box 1291, Jackson, Mississippi

Overcup Oak N. A.

Located within the Mississippi National Forests near S. Hwy 16 and the town of Yazoo City in Sharkey Co.

SAF Type 96, Overcup oak-water hickory, aver. age 200 yrs.	40A

Overcup oak aver. ht. 110′; aver. dia. 28″
Elevation: Low—85′; High—90′
Topography: Level
Geology: Alluvial
Mail Address: For. Sup., P.O. Box 1291, Jackson, Mississippi

Missouri

Current River N. A.

Located on private lands near County Hwy P and the town of Bunker in Shannon Co.

SAF Type 53, White oak, aver. age 250 yrs.	10A
SAF Type 53, (buffer-cutover)	10
Total	20A

White oak aver. ht. 80′; aver. dia. 19″
Red oak aver. ht. 70′; aver. dia. 13″
Blackgum aver. ht. 70′; aver. dia. 14″
Elevation: Low—820′; High—960′
Topography: Steep north-facing slope also stream bottom
Geology: Deeply dissected limestone, Clarksville stony loam soil
Mail Address: Director, School of Forestry, University of Missouri, Columbia, Missouri

Montana

Cliff Lake N. A.

Located within the Beaverhead N. F. near S. Hwy 1 in Madison Co. West Yellowstone is 40 miles ESE by road.

SAF Type 210, Interior Douglas-fir, aver. age 200 yrs.	300A
SAF Type 217, Aspen, age unknown	32
SAF Type 218, Lodgepole pine, aver. age, 80 yrs.	1034
Grassland, sagebrush	935
Total	2301A

Lodgepole pine aver. ht. unknown; aver. dia. 7″
Douglas-fir aver. ht. 60′; aver. dia. 18″
Aspen aver. ht. unknown; aver. dia. 5″
Elevation: Low—6400′; High—7500′
Topography: Rolling, bounded on south and east by steep slopes
Geology: Volcanic
Mail Address: For. Sup., Dillon, Montana

Coram N. A.

Located within the Flathead N. F. near F. Hwy 2 and the town of Martin City in Flathead Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 200 yrs.	8A
SAF Type 210, Interior Douglas-fir, aver. age 300 yrs.	175
SAF Type 212, Larch—Douglas-fir, aver. age 300 yrs.	605
SAF Type 215, Western white pine, aver. age 175 yrs.	21
Marsh	2
Total	811A

Western larch aver. ht. 130′; aver. dia. 22″
Douglas-fir aver. ht. 100′; aver. dia. 22″
Elevation: Low—3500′; High—4750′
Topography: Steep
Geology: Sedimentary shales
Mail Address: For. Sup., Kalispell, Montana

Red Rock Lakes N. A.

Located within the Red Rock Lakes Migratory Waterfowl Refuge near the town of Monida in Beaverhead Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 150 yrs.	2
SAF Type 210, Interior Douglas-fir, aver. age 150 yrs.	81A
SAF Type 215, Western white pine, aver. age 150 yrs.	2
Total	85A

Douglas-fir aver. ht. 70′; aver. dia. 12″
White pine aver. ht. 70′; aver. dia. 12″
Elevation: Low—7,400′; High—8,600′
Topography: Very steep
Geology: Sedimentary
Mail Address: Ref. Mgr., Monida, Montana

Nebraska

Fort Niobrara N. A.

Located within the Fort Niobrara N.W.R. near S. Hwy 12 and the town of Valentine in Cherry Co.

SAF Type 236, Bur oak, aver. age 40 yrs.	75A
SAF Type 237, Interior ponderosa pine, aver. age 40 yrs.	200
Total	275A

Bur oak aver. ht. 34′; aver. dia. 7″
Ponderosa pine aver. ht. 36′; aver. dia. 12″
Elevation: Low—2,331′; High—2,667′
Topography: Steep and broken
Geology: Loessial sand over clay
Mail Address: Ref. Mgr., Valentine, Nebraska

Nevada

Sweetwater N. A.

Located within the Toiyabe N.F. near S. Hwy 22 and the town of Wellington in Lyon Co.

SAF Type 239, Pinyon-juniper, aver. age 40 yrs.	2,235A

Pinyon pine aver. ht. 15′; aver. dia. 8″
Elevation: Low—6,500′; High—7,500′
Topography: Steep
Geology: Granitic
Mail Address: For. Sup., 1555 South Wells, Reno, Nevada

New Hampshire

The Bowl N. A.

Located within the White Mt. N.F. near S. Hwy 113 and the town of Wonalancet in Grafton Co.

SAF Type 18, Paper birch, aver. age 70 yrs.	16A
SAF Type 25, Sugar maple-beech-yellow birch, aver. age 150 yrs.	96
SAF Type 32, Red spruce, aver. age 150 yrs.	343
Sub-Alpine	55
Total	510A

Red spruce aver .ht. 75′; aver. dia. 20″
Yellow birch aver. ht. 65′; aver. dia. 22″
Sugar maple aver. ht. 65′; aver. dia. 24″
Beech aver. ht. 55′; aver. dia. 20″
Elevation: Low—1,900′; High—3,985′
Topography: Steep
Geology: Glaciated
Mail Address: For. Sup., Laconia, New Hampshire

Forks of the Diamond N. A.

Located on Dartmouth College property near S. Hwy 16 and the town of Second College Grant (Unorganized Place) in Coos Co.

SAF Type 5, Balsam fir, aver. age 50 yrs.	70A

Balsam fir aver. ht. 60′; aver. dia. 14″
Elevation: Low—1,300′; High—1,300′
Topography: Flat
Geology: Moraine
Mail Address: College Forester, P.O. Box 731, Hanover, N. H.

Pisgah N. A.

Located within the Harvard Forest near S. Hwy 119 and the town of Hinsdale in Cheshire Co.

Blowdown reproduction, mostly northern hardwoods hemlock and oak	20A

This tract was completely blown down in hurricane of 1938 and although not strictly a natural area in terms of the Society of American Foresters' definition, it has been and will be left completely alone to develop naturally.
Elevation: Low—1,050′; High—1,150′
Topography: Steep and broken
Geology: Glacial mantle
Mail Address: Director, Harvard Forest, Petersham, Mass.

New Jersey

Wm. L. Hutcheson Memorial Forest N. A.

Located in Rutgers University property near Amwell Road and the town of East Millstone in Somerset Co.

SAF Type 52, White oak-red oak-hickory, aver. age 250 yrs.	65A

White oak aver. ht. 90′; aver. dia. 18″
Red oak aver. ht. 90′; aver. dia. 15″
Pin oak aver. ht. 85′; aver. dia. 17″
Blackgum aver. ht. 50′; aver. dia. 6″
Black oak aver. ht. 90′; aver. dia. 18″
Elevation: Low—70′; High—85′
Topography: Rolling
Geology: Triassic shales of the Piedmont
Mail Address: Murray F. Buell, Professor of Botany, Rutgers University, New Brunswick, N. J.

New Mexico

Monument Canyon N. A.

Located within the Santa Fe N.F. near S. Hwy 4 and the town of Jemez Springs in Sandoval Co.

SAF Type 210, Interior Douglas-fir, aver. age 125 yrs.	36A
SAF Type 237, Interior ponderosa pine, aver. age 125 yrs.	590
Brush	14
Total	640A

Ponderosa pine aver. ht. 65′; aver. dia. 22″
Douglas-fir aver. ht. 65′; aver. dia. 22″
Elevation: Low—7,800′; High—8,400′
Topography: Level broken by small canyons
Geology: Volcanic
Mail Address: For. Sup., Santa Fe, New Mexico

New York

Huntington N. A.

Located within the Archer and Anne Huntington Wildlife Forest (State University College of Forestry) near S. Hwy 28N and the town of Newcomb in Hamilton Co.

SAF Type 25, Sugar maple-beech-yellow birch, aver. age 175 yrs.	537A
SAF Type 30, Red spruce-yellow birch, aver. age 100 yrs.	418
SAF Type 33, Red spruce-balsam fir, aver. age 100 yrs.	5
Barren	67
Total	1027A

Sugar maple aver. ht. 70′; aver. dia. 22″
Yellow birch aver. ht. 65′; aver. dia. 20″
Elevation: Low—1,694′; High—2,110′
Topography: Rolling with small mountains
Geology: Glaciated, soil from unsorted till
Mail Address: Asst. Prof. in Charge, Newcomb, New York

Pack Demonstration Forest N. A.

Located within the Pack Demonstration Forest (State University College of Forestry) near F. Hwy 9 and S. Hwy 28 and the town of Warrensburg in Warren Co.

SAF Type 23, Hemlock, aver. age 200 yrs.	27A
SAF Type 39, Black ash-American elm-red maple, aver. age 200 yrs.	9
Swamp	11
Total	47A

White pine aver ht. 110′; aver. dia. 35″
Hemlock aver. ht. 90′; aver, dia. 38″
Hardwoods aver. ht. 90′; aver. dia. 28″
Elevation: Low—840′; High—860′
Topography: Level
Geology: Moraine (surrounded by eskars)
Mail Address: Forest Manager, Warrensburg, New York

Wolf Pond N. A.

Located within Forest District #8 near S. Hwy 3 and the town of Wanakena in Herkimer Co.

SAF Type 21, White pine, aver. age 80 yrs.	10A

White pine aver. ht. 75′; aver. dia. 13″

Elevation: Low—1,778′; High—1,810′
Topography: Steep slope
Geology: Deep glacial soil underlain by igneous rock
Mail Address: Dist. Forester, N. Y. S. Conservation Dept., Herkimer, New York

Five Ponds-Wolf Pond N. A.

Located within Forest District #8 near S. Hwy 3 and the town of Wanakena in Herkimer Co.
SAF Type 30, Red spruce-yellow birch, aver. age 200 yrs. 25A
Red spruce aver. ht. 95′; aver. dia. 20″
Yellow birch aver. ht. 90′; aver. dia. 24″
Elevation: Low—1,780′; High—1,860′
Topography: Rolling with gentle to steep slopes
Geology: Deep glacial soil underlain by igneous rock
Mail Address: Dist. Forester, N. Y. S. Conservation Dept., Herkimer, New York

Totten and Crossfield N. A.

Located within Forest District #8 near S. Hwy 3 and the town of Star Lake in Herkimer Co.
SAF Type 31, Red spruce-sugar maple-beech, aver. age 175 yrs. 150A
Red spruce aver. ht. 95′; aver. dia. 18″
Sugar maple aver. ht. 85′; aver. dia. 22″
Beech aver. ht. 80′; aver. dia. 20″
Elevation: Low—1,680′; High—1,760′
Topography: Rolling with moderate slopes
Geology: Deep glacial soil underlain by igneous rock
Mail Address: Dist. Forester, N. Y. S. Conservation Dept., Herkimer, New York

Plateau Mountain N. A.

Located within Forest District #12 near S. Hwy 23A and the town of Tannersville in Greene Co.
SAF Type 33, Red spruce-balsam fir, aver. age 250 yrs. 15A
Red spruce aver. ht. 60′; aver. dia. 30″
Balsam fir aver. ht. 50′; aver. dia. 12″
Elevation: Low—3,760′; High—3,855′
Topography: Mostly level, plateau-like top of mountain
Geology: Shallow, residual soil underlain by sedimentary rock
Mail Address: Dist. Forester, N. Y. S. Conservation Dept., Catskill, New York

Cornell Mountain-Slide Mountain N. A.

Located within Forest District #13 near S. Hwy 28 and the town of Phoenicia in Ulster Co.
SAF Type 33, Red spruce-balsam fir, aver. age 250 yrs. 20A
Red spruce aver. ht. 70′; aver. dia. 25″
Balsam fir aver. ht. 60′; aver. dia. 14″
Elevation: Low—3,400′; High—3,700′
Topography: Fairly steep slope
Geology: Shallow to moderately deep soil, probably mostly residual, underlain by sedimentary rock layers
Mail Address: Dist. Forester, N. Y. S. Conservation Dept., Middletown, New York

North Carolina

Mattamuskeet N. A.

Located within the Mattamuskeet N.W.R. near F. Hwy 264 and the town of Swan Quarter in Hyde Co.
SAF Type 81, Loblolly pine, aver. age 50 yrs. 75A
Loblolly pine aver. ht. 60′; aver. dia. 18″
Sweetgum aver. ht. 40′; aver. dia. 12″
Elevation: Low—1′; High—3′
Topography: Level
Geology: Alluvial
Mail Address: Refuge Manager, New Holland, N. C.

Black Mountain N. A.

Located within the Pisgah N.F. near the town of Marion in Yancey Co.

SAF Type 25, Sugar maple-beech-yellow birch	126A
SAF Type 34, Red spruce-Fraser fir	542
SAF Type 44, Chestnut oak	229
SAF Type 52, White oak-red oak-hickory	395
Barren	113
Total	1405A

Red spruce aver. dia. 36″
Elevation: Low—2,500′; High—6,400′
Topography: Steep
Mail Address: For. Sup., 42 N. French Road, Asheville, N. C.

Oregon

Goodlow Mountain N. A.

Located within the Fremont N.F. near the town of Bonanza in Klamath Co.

SAF Type 237, Interior ponderosa pine, aver. age 200 yrs.	1081A
SAF Type 238, Western juniper, aver. age 100 yrs.	100
Sagebrush and grass	79
Total	1260A

Ponderosa pine aver. ht. 100′; aver. dia. 30″
White fir aver. ht. 100′; aver. dia. 26″
Elevation: Low—4,900′; High—5,300′
Topography: Gentle rolling to moderately steep
Geology: Decomposed igneous rock of volcanic origin
Mail Address: For. Sup., Lakeview, Oregon

Metolius N. A.

Located within the Deschutes N.F. near F. Hwy 20, F.S. Hwy 113 and the town of Sisters in Jefferson Co.
SAF Type 214, Ponderosa pine—larch—Douglas-fir, aver. age 300 yrs. 1355A
Ponderosa pine aver. ht. 100′; aver. dia. 21″
Elevation: Low—2,850′; High—4,800′
Topography: Level to steep
Geology: Volcanic fault
Mail Address: For. Sup., Bend, Oregon

Pringle Falls N. A.

Located within the Deschutes N.F. near F. Hwy 97 and the town of Lapine in Deschutes Co.

SAF Type 214, Ponderosa pine—larch—Douglas-fir, aver. age 300 yrs.	560A
SAF Type 218, Lodgepole pine, aver. age 60 yrs.	600
Total	1160A

Ponderosa pine aver. ht. 110′; aver. dia. 21″
Lodgepole pine aver. ht. 40′; aver. dia. 5-11″
Elevation: Low—4,300′; High—4,850′
Topography: Level
Geology: Volcanic pumice
Mail Address: For. Sup., Bend, Oregon

Port-Orford-Cedar N. A.

Located within the Siskiyou N.F. near S. Hwy 242 and the town of Powers in Coos Co.

SAF Type 231, Port-Orford-cedar—Douglas-fir, aver. age 500 yrs.	811A
SAF Type 229, Pacific Douglas-fir, aver. age 500 yrs.	311
Total	1122A

Port-Orford-cedar aver. ht. 175′; aver. dia. 40″
Douglas-fir aver. ht. 200′; aver. dia. 48″
Elevation: Low—850′; High—2,300′
Topography: Steep
Mail Address: For. Supt., P.O. Box 440, Grants Pass, Oregon

Coquille River Falls N. A.

Located within the Siskiyou N.F. near S Hwy 242 and the town of Powers in Coos Co.
SAF Type 231, Port-Orford-cedar—Douglas-fir, aver. age 500 yrs. 500A
Port-Orford-cedar aver ht. 175′; aver. dia. 40″
Douglas-fir aver. ht. 200′; aver. dia. 50″
Elevation: Low—1,000′; High—2,500′
Mail Address: For. Supt., Box 440, Grants Pass, Oregon

Canyon Creek N. A.

Located within the Malheur N.F. near F. Hwy 395 and the town of Canyon City in Grant Co.

SAF Type 237, Interior ponderosa pine, aver. age 225 yrs.	650A
Grass	50
Total	700A

Ponderosa pine aver. ht. 115′; aver. dia. 28″
Western larch aver. ht. 115′; aver. dia. 23″
Elevation: Low—4,700′; High—5,800′
Topography: Broken to steep
Geology: Volcanic
Mail Address: For. Sup., John Day, Oregon

Ochoco Divide N. A.

Located within the Ochoco N.F. near F. Hwy 26 and the town of Mitchell in Wheeler Co.

SAF Type 212, Larch—Douglas-fir, aver. age 200 yrs.	907A
SAF Type 237, Interior ponderosa pine, age 300 yrs.	968
Grass	45
Total	1920A

Ponderosa pine aver. ht. 90′; aver. dia. 22″
Western larch aver. ht. 90′ aver. dia. 19″
Elevation: Low—4,450′ High—5,200′
Topography: Level—broken
Geology: Volcanic
Mail Address: For. Sup., Prineville, Oregon

Persia M. Robinson N. A.

Located within the Mt. Hood N.F. near F. Hwy 26 and the town of Maupin in Wasco Co.

SAF Type 211, White fir	420A
SAF Type 229, Pacific Douglas-fir	80
SAF Type 245, Pacific ponderosa pine	140
Total	640A

Elevation: 3,000′
Topography: Rolling
Geology: Volcanic
Mail Address: For. Sup., P.O. Box 5241, Portland 16, Oregon

Abbott Creek N. A.

Located within the Rogue N.F. near S. Hwy 230 and 62 and the town of Prospect in Jackson Co.

SAF 243, Ponderosa pine—sugar pine—fir	2055A
Open area	605
Total	2660A

Douglas-fir aver. ht. 170′; aver. dia. 36″
Sugar pine aver. ht. 160′; aver. dia. 46″
Elevation: Low—3,500′; High—6,100′
Topography: Steep
Geology: Volcanic—Andesitic pumice and andesite
Mail Address: For. Sup., P.O. Box 512, Medford, Oregon

Neskowin Crest N. A.

Located within the Siuslaw N.F. near F. Hwy 101 and the town of Neskowin in Tillamook Co.

SAF 223, Sitka spruce, aver. age 300 yrs.	127A
SAF 224, Western hemlock, aver. age 110 yrs.	305
SAF 225, Sitka spruce-western hemlock, aver. age 110 years.	260
Total	692A

Sitka spruce (old growth) aver. ht. 240′; aver. dia. 84″
Sitka spruce (young growth) aver. ht. 170′; aver. dia. 36″
Western hemlock aver. ht. 160′; aver. dia. 28″
Elevation: Low—sea level; High—1,350′
Topography: Broken
Geology: Sedimentary with volcanic extrusions.
Mail Address: For. Sup., Smith Bldg., Corvallis, Oregon

Pennsylvania

Tionesta N. A.

Located within the Allegheny N.F. near F. Hwy 6 and the town of Ludlow in McKean Co.

SAF Type 23, Hemlock, aver. age 300 yrs.	2113A

Hemlock aver. ht. 125′; aver. dia. 30″
Beech aver. ht. 100′; aver. dia. 20″
Elevation: Low—1,550′; High—1,980′
Topography: Steep sided, narrow lower stream valleys cut into a plateau with shallow dissection at the heads of drainage and broad flat ridges
Geology: Complex of shale and sandstone strata of Mississippian and Pennsylvania ages; non-glacial
Mail Address: For. Sup., Upper Darby, Pennsylvania

Puerto Rico

Luquille N. A.

Located within the Luquille Experimental Forest near P.R. Hwy 191 and the town of Mameyes

Tabonuco Type, aver. age 200 yrs.	1500A
Colorado Type, aver. age 200 yrs.	1700
Palm Type, aver. age 200 yrs.	300
Total	3500A

Dacryodes excelsa aver. ht. 75′; aver. dia. 24″
Cyrilla racemiflora aver. ht. 40′; aver. dia. 14″
Elevation: Low—800′; High—3,000′
Topography: Steep and broken
Geology: Residual soil, derived from Andesite
Mail Address: Director, Tropical Forest Research Center, Box 577, Rio Piedras, P.R.

South Carolina

Bulls Island N. A.

Located within the Cape Romain N.W.R. near F. Hwy 17 and the town of Mt. Pleasant in Charleston Co.

SAF Type 74, Sand live oak-cabbage palmetto, aver. age 90 yrs.	500A
SAF Type 82, Loblolly pine-hardwood, aver. age 90 yrs.	500
Total	1000A

Loblolly pine aver. ht. 45′; aver. dia. 16″
Sand live oak aver. ht. 27′; aver. dia. 20″
Cabbage palmetto aver. ht. 24′; aver. dia. 10″
Elevation: Low—1′; High—15′
Topography: Level with exception of sand dunes of 5′ to 15′
Geology: Barrier beach island
Mail Address: Refuge Manager, P.O. Box 138, McClellanville, South Carolina

Juniper Bay N. A.

Located within the Manchester S.F. near S. Hwy 261 and the town of Pinewood in Sumter Co.

SAF Type 97, Atlantic white-cedar, aver. age 50 yrs.	10A

Atlantic white-cedar, aver. ht. 89′; aver. dia. 15″
Elevation: Low—195′; High—200′
Topography: Level
Geology: Coastal plain—Carolina "Bay" formation
Mail Address: State Forester, P.O. Box 357, Columbia, S. C.

South Dakota

Upper Pine Creek N. A.

Located within the Black Hills N.F. near F. Hwy 16A and the town of Hill City in Pennington and Custer Cos.

SAF Type 201, White spruce, aver. age 200 yrs.	50A
SAF Type, 237, Interior ponderosa pine, aver. age 200 yrs	480
SAF Type 237, Interior ponderosa pine, aver. age 50 yrs.	500
Barren	160
Total	1190A

Ponderosa pine aver. ht. 40′; aver. dia. 14″
White spruce aver. ht. 60′; aver. dia. 14″
Elevation: Low—5,400′; High—6,800′
Topography: Steep and broken
Geology: Volcanic
Mail Address: For. Sup., Custer, South Dakota

Texas

Pine Canyon N. A.

Located within the Big Bend N.P. near Park Road, Route 2 and the town of Marathon in Brewster Co.

SAF Type 237, Interior ponderosa pine, aver. age 200 yrs.	160A
SAF Type 239, Pinyon juniper, aver. age 125 yrs.	160
Total	320A

Ponderosa pine aver. ht. 50′; aver. dia. 20″
Pinyon aver. ht. 25′; aver. dia. 15″
Elevation: Low—5,000′; High—6,500′
Topography: Steep canyon sides and narrow canyon bottom—rocky
Geology: Tertiary sedimentary to top of ridges which are volcanic extrusive
Mail Address: Park Supt., Big Bend N. P., Texas

Utah

Amphitheatre N. A.

Located within the Cedar Breaks N.M. near S. Hwy 14 and the town of Cedar City in Iron Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 100 yrs.	1899A
SAF Type 209 Bristlecone pine, aver. age 750 yrs.	27
SAF Type 210, Interior Douglas-fir, aver. age 75 yrs.	132
Barren	3172
Total	5230A

Douglas-fir aver. ht. 30′; aver. dia. 16″
Engelmann spruce aver. ht. 40′; aver. dia. 22″
Bristlecone pine aver. ht. 25′; aver. dia. 24″
Elevation: Low—8,200′; High—10,662′
Topography: Very steep escarpment. Rim portion fairly flat
Geology: Deeply eroded amphitheater in the escarpment of the Hurrican Fault
Mail Address: Park Supt., Cedar City, Utah

Virginia

Chincoteague N. A.

Located within the Chincoteague N.W.R. near S. Hwy 175 and the twon of Chincoteague in Accomack Co.

SAF Type 80, Loblolly pine-shortleaf pine, aver. age 50 yrs.	200A

Loblolly pine aver. ht. 65′; aver. dia. 25″
Shortleaf pine aver. ht. 50′; aver. dia. 20″
Elevation: Low—sea level; High—35′
Topography: Level to sand dunes of 35′
Geology: Barrier sand beach
Mail Address: Refuge Manager, P.O. Box 62, Chincoteague, Va.

Ramsey's Draft N. A.

Located within the George Washington N.F. near F. Hwy 250 and the town of Staunton in Augusta Co.

SAF Type 21, White pine, aver. age 150 yrs.	200A
SAF Type 41, Scarlet oak, aver. age 100 yrs.	30
SAF TYPE 59, Yellow-poplar-white oak-northern red oak, aver. age 150 yrs.	53
Total	283A

White pine aver. ht. 120′; aver. dia. 36″
Hemlock aver. ht. 120′; aver. dia. 40″
Elevation: Low—2,000′; High—4,200′
Topography: Steep
Geology: Sedimentary rock
Mail Address: For. Sup., Federal Bldg., Harrisonburg, Va.

Little Laurel Run N. A.

Located within the George Washington N.F. near F. Hwy 33 and the town of Harrisonburg in Rockingham Co.

SAF Type 21, White pine, aver. age 150 yrs.	170A
SAF Type 41, Scarlet oak, aver. age 80 yrs.	440
Total	610A

White pine aver. ht. 120′; aver. dia. 42″
Hemlock aver. ht. 120′; aver. dia. 45″
Elevation: Low—2,400′; High—3,500′
Topography: Steep
Geology: Sedimentary rock
Mail Address: For. Sup., Federal Bldg., Harrisonburg, Va.

Wisconsin

Necedah N. A.

Located within the Necedah N.W.R. near S. Hwy 80 and the town of Necedah in Juneau Co.

SAF Type 1, Jack pine, aver. age 30 yrs.	80A

Jack pine aver. ht. 40′; aver. dia. 5″
Black oak aver. ht. 50′; aver. dia. 8″
Elevation: Low—926′; High—930′
Topography: Level
Geology: Alluvial (sand)
Mail Address: Refuge Manager, Necedah, Wisconsin

Big Block N. A.

Located within the Flambeau River State Forest near Co. Trunk "M" Hwy and town of Hawkins in Sawyer Co.

SAF Type 24, Hemlock-yellow birch, aver. age 220 yrs.	270A
SAF Type 25, Sugar maple-beech-yellow birch, aver. age 220 yrs.	46
Total	316A

Hemlock aver. ht. 68′; aver. dia. 21″
Yellow birch aver. ht. 65′; aver. dia. 21″
Sugar maple aver. ht. 68′; aver. dia. 19″
Basswood aver. ht. 74′; aver. dia. 26″
Topography: Level
Geology: Moraine
Mail Address: Forest Manager, Flambeau River State Forest, Winter, Wisconsin

Washington

Long Creek N. A.

Located within the Mt. Baker N.F. near the town of Granite Falls in Snohomish Co.

SAF Type 224, Western hemlock, aver. age 250 yrs.	460A
SAF Type 227, Western redcedar-western hemlock, aver. age 350 yrs.	100
SAF Type 230, Douglas-fir—western hemlock, aver. age 350 yrs.	40
Total	600A

Douglas-fir aver. ht. 160′; aver. dia. 48″
Western redcedar aver. ht. 140′; aver dia. 60″
Elevation: Low—1,500′; High—3,500′
Topography: Steep
Geology: Alluvial
Mail Address: For. Sup., P.O. Box 945, Bellingham, Wash.

Lake 22 N. A.

Located within the Mt. Baker N.F. near the town of Granite Falls in Snohomish Co.

SAF Type 221, Red alder	15A
SAF Type 222, Black cottonwood-willow	10
SAF Type 226, Pacific silver fir-hemlock	80
SAF Type 227, Western redcedar-western hemlock	435
SAF Type 228, Western redcedar	40
Non-forested	210
Total	790A

Elevation: Low—110′; High—4,300′
Topography: Steep and broken
Geology: Volcanic
Mail Address: For. Sup., Box 945, Bellingham, Washington

Wind River N. A.

Located within the Gifford Pinchot N.F. near Hwy Wind River 8-C and the town of Carson in Skamania Co.

SAF Type 229, Pacific Douglas-fir, aver. age 400 yrs.	1180A

Douglas-fir aver. ht. 150′; aver. dia. 40″
Hemlock aver. ht. 100′; aver. dia. 30″
Elevation: Low—1,100′; High—2,000′
Topography: Rolling
Geology: Volcanic
Mail Address: For. Sup., Box 449, Vancouver, Washington

Meeks Table N. A.

Located within the Snoqualmie N.F. near F. Hwy 410 and the town of Naches in Yakima Co.

SAF Type 214, Ponderosa pine—larch—Douglas-fir, aver. age 200 yrs.	21A
SAF Type 237, Interior ponderosa pine, aver. age 300 yrs.	38
Grassland	9
Total	68A

Ponderosa pine aver. ht. 80′; aver. dia. 20″
Elevation: Low—4,300′; High—4,500′
Topography: Rolling
Geology: Volcanic
Mail Address: For. Sup., 905 Second Avenue Bldg., Seattle 4, Washington

Cedar Flats N. A.

Located within the Gifford Pinchot N.F. near the town of Woodland in Skamania Co.

SAF Type 224, Western hemlock, aver. age 300 yrs.	6A
SAF Type 228, Western redcedar, aver. age 400 yrs.	23
SAF Type 229, Pacific Douglas-fir, aver. age 350 yrs.	335
Total	364A

Douglas-fir aver. ht. 200′; aver. dia. 48″
Western redcedar aver. ht. 150′; aver. dia. 50″
Elevation: Low—1,200′; High—1,800′
Topography: Level
Geology: Alluvial
Mail Address: For. Sup., Box 449, Vancouver, Washington

Quinault N. A.

Located within the Olympic N.F. near F. Hwy 101 and the town of Aberdeen in Grays Harbor Co.

SAF Type 223, Sitka spruce, aver. age 400 yrs.	380A
SAF Type 224, Western hemlock, aver. age 300 yrs.	890
SAF Type 228, Western redcedar, aver. age 300 yrs.	120
SAF Type 229, Pacific Douglas-fir, aver. age 500 yrs.	50
Total	1440A

Douglas-fir aver. ht. 200′; aver. dia. 50″
Western hemlock aver. ht. 150′; aver. dia. 30″
Western redcedar aver. ht. 120′; aver. dia. 50″
Sitka spruce aver. ht. 180′ aver.; dia. 50″
Elevation: Low—300′; High—1,000′
Topography: Level to rolling to steep
Geology: Glacial moraine
Mail Address: For. Sup., Olympia, Washington

North Fork Nooksack N. A.

Located within the Mt. Baker N.F. near S. Hwy 1 and the town of Glacier in Whatcom Co.

SAF Type 224, Western hemlock, aver. age 35 yrs.	133A
SAF Type 227, Western redcedar-western hemlock, aver. age 400 yrs.	437
SAF Type 229, Pacific Douglas-fir, aver. age 400 yrs.	482
SAF Type 230, Douglas-fir—western hemlock, aver. age 300 yrs.	296
Total	1348A

Douglas-fir aver. ht. 200′; aver. dia. 50″
Western redcedar aver. ht. 180′; aver. dia. 72″
Elevation: Low—1,700′; High—4,800′
Topography: Steep
Geology: Moraine
Mail Address: For. Sup., Box 945, Bellingham, Washington

Varline Grove-Flodelle Creek N. A.

Located within the Little Pend Oreille N.W.R. near S. Hwy 6-A and the town of Colville (20 miles) in Stevens Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 140 yrs.	15A
SAF Type 212, Larch—Douglas-fir, aver. age 250 yrs.	80
SAF Type 218, Lodgepole pine, aver. age 60 years.	57
Non-forested	8
Total	160A

Douglas-fir aver. ht. 135′; aver. dia. 28″
Western larch aver. ht. 120′; aver. dia. 24″
Engelmann spruce aver. ht. 110′; aver. dia. 16″
Lodgepole pine aver. ht. 60′; aver. dia. 6″
Elevation: Low—3,100′; High—3,500′
Topography: Rolling with small streams
Geology: Alluvial
Mail Address: Ref. Mgr., Route 1, Colville, Washington

Baird Basin N. A.

Located within the Little Pend Oreille N.W.R. near S. Hwy 6-A and the town of Colville (19 miles) in Stevens Co.

SAF Type 212, Larch—Douglas-fir, aver. age 60 yrs.	62A
SAF Type 214, Ponderosa pine—larch—Douglas-fir, aver. age 250 yrs.	63
SAF Type 218, Lodgepole pine, aver. age 80 yrs.	35
Total	160A

Ponderosa pine aver. ht. 130′; aver. dia. 24″
Western larch aver. ht. 120′; aver. dia. 20″
Douglas-fir aver. ht. 120′ aver. dia. 20″
Lodgepole pine aver. ht. 70′; aver. dia. 5″
Elevation: Low—3,100′; High—3,500′
Topography: Rolling
Geology: Alluvial
Mail Address: Ref. Mgr., Route 1, Colville, Washington

Jackson Creek N. A.

Located within Olympic National Park near F. Hwy 101 and the town of Forks in Jefferson Co.

SAF Type No. 229, Pacific Douglas-fir, aver. age 370 yrs.	160A

Douglas-fir aver. ht. 230′; aver. dia. 50″
Elevation: Low—500′; High—2,100′
Topography: Rolling
Geology: Alluvial
Mail Address: Supt., Port Angeles, Washington

Twin Creek N. A.

Located within Olympic N.P. near F. Hwy 101 and the town of Forks in Jefferson Co.

SAF Type 223, Sitka spruce	100A

Sitka spruce aver. ht. 200′; aver. dia. 46″
Elevation: Low—490′; High—650′
Topography: Level
Geology: Alluvial
Mail Address: Supt., Port Angeles, Washington

Hades Creek N. A.

Located within Olympic N.P. near the town of Forks in Jefferson Co.

SAF Type 226, Pacific silver fir—hemlock, aver. age 170 yrs.	560A

Silver fir aver. ht. 169′; aver. dia. 33″
Hemlock aver. ht. 154′; aver. dia. 30″
Elevation: Low—500′; High—2,200′
Topography: Steep
Geology: Alluvial
Mail Address: Supt., Port Angeles, Washington

Higley Creek N. A.

Located within Olympic N.P. near town of Quinault in Grays Harbor Co.

SAF Type 224, Western hemlock, aver. age 170 yrs.	480A

Western hemlock aver. ht. 190′; aver. dia. 29″
Elevation: Low—400′; High—1,800′
Topography: Level to steep
Geology: Alluvial
Mail Address: Supt., Port Angeles, Washington

Wyoming

Snowy Range N. A.

Located within the Medicine Bow N.F. near S. Hwy 130 and town of Centennial in Albany Co.

SAF Type 206, Engelmann spruce-subalpine fir, aver. age 175 yrs.	665A
SAF Type 218, Lodgepole pine, aver. age 160 yrs.	74
Barren	32
Total	771A

Engelmann spruce aver. ht. 75′; aver. dia. 19″
Lodgepole pine aver. ht. 70′; aver. dia. 14″
Elevation: Low—9,300′; High—10,500′
Topography: Rolling
Geology: Granite
Mail Address: For. Sup., Box 971, Laramie, Wyoming

Bull Elk Park N. A.

Located within the Big Horn N.F. near F. Hwy 14 and the town of Dayton in Sheridan Co.

SAF Type 218, Lodgepole pine, aver. age 160 yrs.	418A
Grass, etc.	300
Total	718A

Lodgepole pine aver. ht. 60′; aver. dia. 12″
Elevation: Low—7,000′; High—7,500′
Topography: Rolling plateau
Geology: Sedimentary limestone and shale
Mail Address: For. Sup., Box 914, Sheridan, Wyoming

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Questions and Answers Concerning State Laws for Registration of Foresters

The following list of questions and answers was compiled by the SAF Committee on Registration and Licensing in order to provide members with the kind of information most commonly asked the Committee.

What is the difference between forester registration laws and forester licensing laws?

Strictly speaking a registration law requires the registration of those practicing, or proposing to practice, the profession; whereas a licensing law gives persons the privilege of practicing the profession. Most professional registration laws, including those involving the forestry profession, include both registration and licensing, and the terms are frequently used synonomously.

What is the purpose of forester registration laws?

All forester registration laws now in effect state that the purpose is for the benefit and protection of the public.

From whom need the public be protected?

From forestry graduates who do not adhere to the principles of accepted forestry practice; from non-foresters doing forestry work for which they are not qualified; and from members of both groups who engage in unethical practices.

Are not foresters also protected?

Qualified foresters in the states where the laws are now in effect do not feel that they need protection. They believe that the quality of their work speaks for itself. They are not so naive, however, as to believe that all foresters are equally qualified, or equally ethical, to the point that the public does not need protection. The promotion of forester registration laws by foresters is one way of foresters taking care of the situation themselves before it is done for them by public demand, and possibly in a manner not to the foresters' liking.

Is not forester registration and licensing a kind of "union"?

It is not. In forester registration the emphasis is on benefiting and protecting the public, rather than the individual or organized group.

Does not the forester receive any benefits from registration and licensing?

Indirectly he benefits by the raising of the standards of forestry practice; by the further recognition of forestry as a profession; and by the additional esteem which the profession of forestry receives from other professions and the general public because of registration. From the forester's standpoint, however, support of registration and licensing is an altruistic rather than an egoistic principle.

Why is the registration and licensing of foresters needed?

In every area where forestry has passed from the textbooks to the woods, thinking and observant foresters realize that not all forestry is being practiced by qualified persons. These foresters realize that the public needs protection against unqualified persons, since the public itself is incapable of recognizing good forestry practice.

How does registration and licensing help the public recognize good forestry practice?

It doesn't. It does, however, give the public a means of recognizing those persons who have been certified as being capable of practicing good forestry, and an assurance that if those persons do not engage in good forestry practice they may be penalized.

Who is to say whether a forester is qualified for registration?

The decision is left to a Board of Registration consisting of professional foresters, recognized for their professional aptitudes and ethical attributes. Registration and licensing is based upon professional training, experience, and/or written examination.

Who selects or appoints this Board?

In most states, Registration Boards of all professions are appointed by the Governor. Qualifications of Board members and their terms of office are usually stated in the registration law, and can be as strict as those writing the law wish to make them.

What is permissive registration?

Most professional registration laws are "permissive" in their early life, meaning that the professional person need not be registered unless he so desires. Registration under a "permissive" law occurs because of pride and increased professional standing. After a period of time most permissive laws are amended so as to become "compulsory" or "mandatory" laws.

Do compulsory or mandatory laws require every forester to become registered?

It is not likely that they will ever require all foresters to be registered. For instance, a forester operating solely on his own lands would probably not be required to be registered; nor would a forester operating solely on the lands of the company or agency by whom he is employed. However, in the strict sense of protection of the public and the public interest, strong arguments can be made to require registration of all practicing foresters.

What is meant by the "grandfather" clause in a registration law?

At the inception of all registration laws, there is a group of persons not professionally trained in the academic sense who have been working within the profession. Some of these persons, because of years of experience, self-study, or other measures, have become highly proficient. The "grandfather" clause allows those of this group who can prove their qualifications by experience and/or examination, to become registered and licensed. The "grandfather" clause usually expires within a comparatively short period of time.

Are all those who become registered required to pass an examination?

The laws now in effect do not require a forester who is a graduate of an approved school, college, or department of forestry, and who has the required experience, to take an examination.

What is the difference between an approved and an unapproved school, college, or department?

In most cases approved forestry schools, colleges, and departments are those accredited by the Society of American Foresters. It is not so stated in the laws since this would give an organization (the Society of American Foresters) which is not a state organization control over a matter which is peculiarly a state

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matter, and its inclusion in the law would undoubtedly lead to a ruling that the law was unconstitutional under the State Constitution. There is nothing, however, to prohibit the Registration Board from *approving only* those schools, colleges, and departments of forestry which are accredited by the Society of American Foresters, or any other schools.

Are the graduates of unapproved schools, colleges, and departments of forestry required to pass an examination?

This depends upon the law in the individual state. They may, at the present time, be required to furnish proof of a longer period of experience, or pass an examination, or both.

How would a newly graduated forester without experience gain experience and become registered?

Under a permissive law he would not need to be registered until he so desired. Under a compulsory law he could gain experience by: (1) working under a registered forester; (2) working solely on the lands of the company or agency by whom he is employed; (3) working solely on his own lands.

Can firms, partnerships, or corporations obtain a "blanket" license covering all of their foresters?

Absolutely not! Licensing is based upon an individual's qualifications and is a personal matter.

Is a roster of registered foresters available to the public?

Certainly, and the wider the distribution the better. State Boards issue annually a revised roster of registrants.

Are registration and license fees large?

No. Registration fees should not be considered as a tax or as a means of raising revenue. At the present time they are very reasonable, and exceptionally low when compared with those in the other professions.

What evidence does a forester receive that he is licensed to practice forestry?

A license and pocket card are issued, and in some states he is encouraged to purchase an impression seal which can be used with certification on maps, reports, and other documents he has issued or supervised.

Upon what grounds can a license be revoked?

Most Boards have the power to revoke the license of any registrant who is found guilty by the Board of gross negligence, incompetency, or misconduct in the practice of forestry. Most forester registration application forms include a code of ethics as a guide to professional conduct to which the applicant is required to subscribe under oath.

Is there any appeal from the Board's decision?

In most states the registrant may appeal to a court of competent jurisdiction.

Is there any penalty, other than revocation of license, for a violation?

In most states the registrant may also be found guilty of a misdemeanor for each and every offense. This can carry a rather stiff penalty in some states.

If a license is revoked may the person be issued another at a later date?

Issuance of another license would be at the discretion of the Board.

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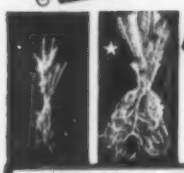

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Gifford Pinchot: Forester—Politician

By M. Nelson McGeary

In this first published biography of a colorful figure, Mr. McGeary covers Pinchot's schooling at Yale and in Europe, his career as America's first native-born forester, his intimate association with Theodore Roosevelt while acting as head of the U. S. Forest Service, and his emulation of Roosevelt while serving as governor of Pennsylvania.

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Is there reciprocity between states in regard to licensing?

There is.

Does licensing of foresters keep some foresters, or those working within the profession, from earning a living in their chosen profession?

Not if they are qualified to practice the profession; if they are not qualified they should not be practicing.

Why isn't being a member of the Society of American Foresters enough of an honor and privilege, or loss of membership enough of a deterrent, to make foresters adhere to good forestry practice?

First, loss of membership in the Society of American Foresters carries no penalty except dishonor among other members; and persons subject to such a penalty would most likely have little honor to lose. Second, based upon states rights, licensing in all professions is historically and constitutionally a state matter. Third, threat of loss of Society of American Foresters membership would have no effect upon foresters, or others, who are not members of the Society of American Foresters.

Why not have licensing on a national rather than on a state level?

As heretofore mentioned, licensing of the professions is historically and constitutionally a state matter involved in states rights. Also, forestry varies so greatly from one region to another, and emphasis on different phases of forestry varies to such a degree, that national licensing seems unwise.

Why do the various registration laws refer to "Registered Foresters" rather than just foresters?

There is no law or precedent which prohibits any person from calling himself by any name such as doctor, accountant, forester, etc., regardless of his training or lack of training. He cannot, however, without being properly licensed and registered call himself a Doctor of Medicine, a Certified Public Accountant, a Registered Forester, etc.

Which states have enacted forester registration and licensing laws?

At the present time three states have such laws. Georgia was first in 1951; Michigan second in 1955; and Alabama third in 1957. Michigan and Alabama have permissive laws; Georgia's was permissive until 1959 when it was amended to become compulsory with a few exceptions. Several other states are preparing registration and licensing bills for foresters at the present time.

ARCHIE E. PATTERSON
Chairman, SAF Committee on Registration and Licensing

Coming Events

Ozark and Kentucky-Tennessee Sections

The Ozark and the Kentucky-Tennessee Sections will hold a joint meeting December 2-3, 1960, at Memphis, Tenn.

Council of Forestry School Executives

The Council of Forestry School Executives will hold its annual meeting November 12, 1960, at Yale University, New Haven, Conn., immediately following the Yale 60th Anniversary.

Forest Service Strengthens Title of "Forester" Positions

Acting through the Committee on Civil Service, the Council of the Society has requested the U. S. Forest Service to discontinue the practice of designating nonforesters with the title of forester. Specifically, in the past regional fiscal agents, regional engineers, and some other assistants to the re-

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gional foresters have been designated as assistant regional foresters when, in fact, they were persons without education in forestry.

The Forest Service has agreed to the stand taken by the Council. In accordance therewith the following exchange of letters will be self-explanatory.

SOCIETY OF AMERICAN FORESTERS
MILLS BUILDING
Washington 6, D. C.

August 10, 1960

Dr. R. E. McArdle, Chief Forester
United States Forest Service
United States Department of Agriculture
Washington 25, D. C.

Dear Dr. McArdle:

At the meeting of the Council of the Society of American Foresters on May 10, 1960, the use of the term forester for positions not requiring professional forestry training was discussed at some length. The Council believes that every effort should be made to insure that the term forester carry the same professional connotation that such terms as engineer and lawyer now do. It was noted, for example, that the fiscal agent in regional offices is called assistant regional forester.

The Council went on record to express its concern to the United States Forest Service over the use of the term "forester" for such positions and to urge that the Forest Service give consideration to finding some other title for those positions.

If it would be helpful, the undersigned would be happy to discuss this matter with Forest Service Personnel at their convenience.

Sincerely,
R. J. PRESTON, *Chairman*
Civil Service Committee
HENRY CLEPPER
Executive Secretary

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Washington, D. C.

August 31, 1960

Mr. R. J. Preston
Civil Service Committee
Society of American Foresters
Mills Building
Washington 6, D. C.

Dear Mr. Preston:

This refers to the August 10 letter from you and Mr. Clepper expressing the Council's feeling about Forest Service use of the title Assistant Regional Forester for non-forester positions in regional offices.

We are in full agreement with the stand taken by the Council of the Society of American Foresters. In fact, it has been the policy of this office to use the working titles of regional engineer and regional fiscal agent rather than assistant regional forester for their nonforester positions. This matter is being called to the attention of all regions as apparently there has been some improper use of the assistant regional forester title.

We trust that this action will meet with the approval of the Council.

Very truly yours,
RICHARD E. MCARDLE, *Chief*
By W. S. SWINGLER

Proposed Amendment of Constitution Adopted

In August a ballot was mailed to all voting members for them to vote on a proposed amendment of Article III, Section 4 of the SAF Constitution as

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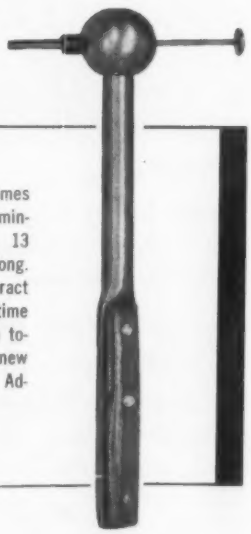

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follows:

"Affiliate Members shall be persons who have had education in forestry but insufficient to meet the requirements of the Junior Member grade.

"Affiliate Members may be elected to Junior Membership on showing proof of eligibility."

September 15 was the final day for receiving the ballots, which have been counted with the following results:

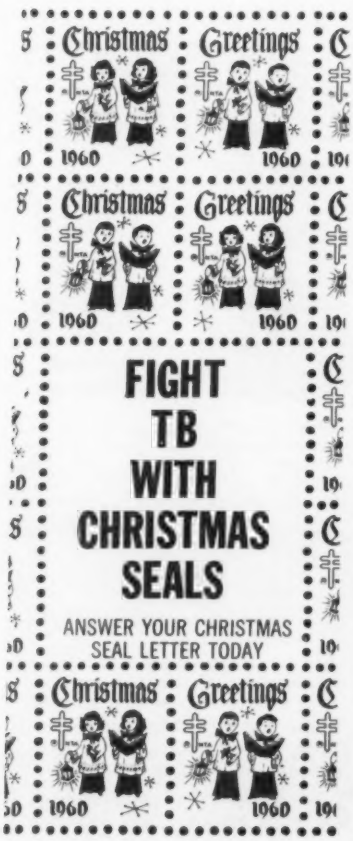
Amendment approved	3,153
Amendment opposed	641

The proposed amendment, having received the necessary two-thirds majority of those voting, is now in effect.

Dues Deductible

In filing U. S. income tax reports, all members may classify dues paid to the Society of American Foresters as deductible expenses.

Dues for 1961 should be paid promptly and in no case should they remain unpaid after June 30, 1961. Members whose dues are not paid by that date become delinquent and will receive no further issues of the JOURNAL OF FORESTRY until dues are paid.



Percy M. Barr (1897-1960)

Percy Munson Barr, professor of forestry at the University of California in Berkeley, died August 27 at the age of 63 from a heart attack. He had been an active teaching and research forester up to the day of his death.

Born in Watertown, Conn., July 22, 1897, he received his early education in the schools of Nova Scotia and British Columbia. He received his Bachelor degree from the University of British Columbia in 1924 and his M.F. and Ph.D. degrees from Yale University in 1925 and 1929. In 1945 the University of British Columbia honored him with a Doctor of Science degree.

He served as a pilot in the Canadian Royal Flying Corps and Royal Air Force from 1915 to 1919, and then returned to military service in the Army of the United States during the second World War. A colonel, he served as chief intelligence officer for the 15th Air Force in Italy. He won the Legion of Merit, Bronze Star, from this country; the Order of the British Empire; and, from France, the Croix de Guerre with palm.

Dr. Barr was chief of the research branch of the British Columbia Forest Service at the time he joined the University of California staff in 1932. He briefly returned to Canada later to reorganize the forestry department at the University of British Columbia.

During his long career at Berkeley, Dr. Barr served as associate to the vice president and provost in 1947, as special assistant to the president in 1948, and for several years as chairman of the Committee on Building and Campus Development. He was a former secretary of the Division of Education of the Society of American Foresters.

Carlile P. Winslow (1884-1960)

Carlile P. Winslow, former director of the Forest Products Laboratory at Madison, Wis., and a Fellow of the Society of American Foresters, died in Washington, D. C., on September 24.

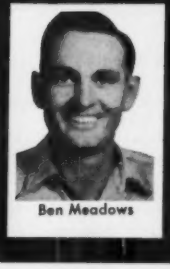
Born in Washington, D. C., on August 5, 1884, Mr. Winslow was graduated in mechanical engineering at the Yale University Sheffield Scientific School in 1905 with the Ph.B. degree.

In 1910 he joined the technical staff of the Forest Products Laboratory, which had been established at Madison that year, cooperatively with the University of Wisconsin. He became director in 1917. In that year the organization had 80 scientists and other workers. The peak was 700 during World War II.

Under Mr. Winslow's directorship the Laboratory became the largest organization in the world devoted to research in the utilization of wood and wood products. He retired as director in 1946, after having served in that capacity for 29 years.

Following his retirement of the directorship, Mr. Winslow became a wood products consultant to the U. S. Forest Service at Washington, D. C., and also to the Department of Defense in Europe and elsewhere.

A member of the Society of American Foresters since 1919, he was elected a Fellow in 1942 in recognition of his contributions to scientific research in wood cellulose and forest utilization.



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Inactive Status

Society members in good standing, temporarily serving in the armed forces, may request that they be placed on inactive status. Inactive members do not receive copies of the JOURNAL OF FORESTRY, nor are they permitted to vote. They are considered as members of the Society and may be restored to active status upon request when returning to civilian life, with payment of current dues only.

Retired Status

Members and Fellows of 20 years or more standing who retire from full-time employment, either in forestry or other fields, with consequent substantial reduction in income, may, upon application to the Council, continue as voting members. Their dues are remitted except for an annual charge of $5 should they desire to receive the JOURNAL OF FORESTRY and other Society publications.

Members granted such retired status in the Society must continue to pay Section dues in order to continue as Section members.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of September are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of November 30, 1960.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Alaska Section

Junior Grade

Durland, D. M., Forester, USFS, Craig, Alaska. Mont. State, BSF, 1950.

Member Grade

Bishop, D. M., Forester, Alaska Forest Research Center, Hollis, Alaska (Junior 1953).

Sandor, J. A., Personnel Officer, USFS, Juneau, Alaska (Affiliate 1952, Junior 1955).

Associate Grade

Schwartz, J. E., Forester, USFS, Juneau, Alaska.

Allegheny Section

Junior Grade

Gamble, H. B., Graduate research work, Pennsylvania State Univ., University Park, Pa. (Reinstatement).

Students Eligible for Automatic Advancement

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Gaskins, E. A. Stump, R. F.

Member Grade

Godden, J. A., Dist. Ranger, USFS, Parsons, West Va. (Junior 51R53).

Johnson, R. J., Forester, United Fuel Gas, Charleston, West Va. (Junior 1953).

Mires, R. B., Forester, Jersey Package Co., Bridgeton, N. J. Pa. State, BSF, 1950 (Junior 1956).

Sheble, E., Hook Rd., Route 4, Westminster, Md. (Junior 1953).

Vinoski, E. B., USFS, Bartow, West Va. (Junior 1953).

Central Rocky Mountain Section

Junior Grade

Browning, E. R., Junior Forester, USFS, Pagosa Springs, Colo. Pa. State, BSF, 1958.

Fiebelkorn, C., Forester, USFS, Durango, Colo. (Reinstatement).

Gryezan, E. J., Asst. Ranger, USDA, Cedaredge, Colo. (Reinstatement).

Hartman, W. L., Dist. Ranger, USFS, Pagosa Springs, Colo. (Reinstatement).

Mahon, J. J., Asst. Ranger, USFS, Pagosa Springs, Colo. Colo. State, BSF, 1952.

McAninch, C. D., Asst. Ranger, USFS, Pagosa Springs, Colo. (Reinstatement).

Myers, C. W., Forester, USFS, Denver, Colo. Colo. State, BSF, 1948.

Roberts, W. B., Dist. Forest Ranger, USDA, Rico, Colo. Colo. State, BSF, 1951.

Scholz, R. H., Forester, USFS, Grand Junction, Colo. Colo. State, BSF, 1950.

Winkler, W. A., Dist. Ranger, USFS, Meeker, Colo. (Reinstatement).

Affiliate Grade

Williams, J. L., Farm Forester, Dept. of Game Fish & Parks, Custer, S. D.

Central States Section

Associate Grade

Bates, G. O., Asst. Chief, Dept. of Natural Resources, Columbus, Ohio.

Columbia River Section

Junior Grade

Baker, R. G., Timber Valuation Specialist, State Tax Comm., Salem, Ore. Ore. State, BS, 1941.

Member Grade

Baker, R. J., 129 Roundup Drive, Eugene, Ore. (Junior 1953).

Gulf States Section

Affiliate Grade

Graham, R. M., Forester, USFS, Brooklyn, Miss.

Murphy, R. E., Forester, International Paper Co., Pineville, La.

Inland Empire Section

Member Grade

Moss, V. D., Research Forester, USFS, Spokane, Wash. (Reinstatement).

Intermountain Section

Affiliate Grade

Stipa, H. A., Forester, State Forestry Dept., Boise, Idaho.

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Kentucky-Tennessee Section

Member Grade

Swatzyna, R. J., Service Forester, Commonwealth of Ky., Pineville, Ky. (Junior 1954).

New England Section

Junior Grade

Berlyn, G. P., Instructor Wood Anatomy, Yale Univ., New Haven, Conn. (Reinstatement).

DeCoster, L. A., Forester, Maine Forest Service, Buckfield, Maine. Univ. Maine, BSF, 1959.

Lee, D. A., Asst. Dist. Forester, Wisconsin Cons. Dept., Ladysmith, Wis. Mich. College Mining and Tech, BSF, 1956.

Member Grade

Wenner, E. J., Forest Supv., USFS, Lakeport, N. H. (Junior 1953).

Affiliate Grade

Snyder, C. F., Service Forester, State Park & Forest Comm., Hartford, Conn.

Northern Rocky Mountain Section

Member Grade

Chapman, H. H., Fire Control Officer, Yellowstone Nat'l. Park, Yellowstone, Wyo. (Junior 1951).

Puget Sound Section

Junior Grade

DeBerard, D. E., Forester, Weyerhaeuser Co., Tacoma, Wash. Colo. State, BSF, 1957.

Dunnell, C. W., Dist. Ranger, USFS, Marblemount, Wash. (Reinstatement).

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Johnson, R. E. McCroan, L.

Junior Grade

Blair, A., St. Regis Paper Co., McIntosh, Ala. (Reinstatement).

Logan, C. A., Forester, Gulf States Paper Corp., Demopolis, Ala. (Reinstatement).

Wood, W. F., Dist. Procurement Supt., Gulf States Paper Corp., Thomasville, Ala. (Reinstatement).

Member Grade

Bailey, J. C., Forest Mgr., Rome Kraft Co., Greenville, Ga. Mich. State, BSF, 1956 (Junior 1956).

Connell, A. M., Procurement Forester, T. R. Miller Co., Brewton, Ala. (Junior 1953).

Glidewell, C. F., Dist. Supv., International Paper Co., Monroeville, Ala. (Junior 1953).

Hill, H. J., Staff Mgmt. Forester, Marathon Southern Co., Butler, Ala. (Junior 1953).

Hinkle, E. H., Research Forester, Union Bag-Camp Paper Corp., Savannah, Ga. Univ. Fla., BSF, 1956, MSF, 1957 (Junior 1956).

Morgan, J. M., Resident Forester, Scott Paper Co., Bay Minette, Ala. (Junior 1953).

Ogletree, W. T., Forester, W. E. Belcher Lbr. Co., Centreville, Ala. (Junior 1951).

Ramage, J. G., Dist. Forester, Hiwassee Land Co., Scottsboro, Ala. (Junior 1953).

Simons, W. W., Area Forester, Coosa River Newsprint Co., Pell City, Ala. (Junior 1953).

Stallworth, D. R., Mgr., Stallworth Naval Stores Co., Vinegar Bend, Ala. (Junior 1953).

Vick, T. B., Unit Forester, International Paper Co., York, Ala. (Junior 1951).

Woodall, J. T., Asst. Forester, Scott Paper Co., Mobile, Ala. La. Tech., BSF, 1953, Duke Univ., MF, 1956 (Junior 1956).

Upper Mississippi Valley Section

Student Grade

IOWA STATE UNIVERSITY

Arganbright, D. G. Bertlshofer, L. J.

Junior Grade

Student Eligible for Automatic Advancement

IOWA STATE UNIVERSITY

Ferguson, N. B.

Washington Section

Member Grade

Howard, H. E., Personnel Officer, USFS, Washington, D. C. (Reinstatement).

Wisconsin-Michigan Section

Member Grade

Andreas, L. G., Instructor, Wisconsin State College, Stevens Point, Wis Iowa State, BSF, 1956, MS, 1960 (Junior 1956).

No Section

Corresponding Grade

Abraham, F. B., Forester, Bureau of Forestry, Manila, Philippines.

Giple, T. W., Forest Ranger, Liberian Government, Monrovia, Liberia.

Klepac, D., Prof., Univ. of Zagreb, Sumarski Fakultet, Maksimir, Yugoslavia.

Larraguibal T. I., Eng., Chilean Government, Santiago, Chile.

Toe, P. B., Forest Ranger, Liberian Government, Monrovia, Liberia.

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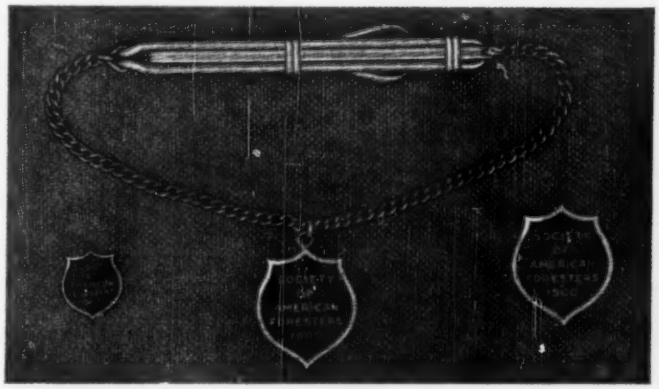

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SOCIETY OF AMERICAN FORESTERS

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Forestry News

THE newly constructed Northern Forest Fire Laboratory of the U. S. Forest Service at Missoula, Mont.

Million Dollar Forest Fire Laboratory Open

The Forest Service's new million dollar Northern Forest Fire Laboratory was formally dedicated at Missoula, Mont., September 12.

The laboratory will be used for basic and applied research on problems of nationwide importance and on special fire problems on 335 million acres of forest and watershed lands in the Intermountain West and Alaska.

Chemists, physicists, meteorologists, and engineers will work on difficult fire problems which face all fire control agencies. The new structure has research facilities needed to develop improved methods and equipment for forest fire prevention and suppression. The facilities can also be used to study the use of prescribed fire as a land management tool.

Dr. Richard E. McArdle, chief of the U. S. Forest Service, Lee Metcalf, U. S. Congressman from Montana, and Dr. Reed W. Bailey, director of the Intermountain Forest and Range Experiment Station, Ogden, Utah, were the principal speakers.

Jack S. Barrows, chief of the Division of Forest Fire Research of the Intermountain Station and administrator of the new research facility, introduced the speakers. Open house was held at the laboratory from 1:30 to 3:45 p.m., ceremonies from 4:00 until 5:00 p.m., and open house from 5:00 until 8:00 p.m. Over 200 persons were present at the dedication and several hundred visited during the open house periods.

Research facilities unique to the study of forest fires are featured in the new laboratory. A fire chamber has been designed for burning experimental fires under controlled conditions of temperature, humidity, and pressure. In the chamber, 120,000 cubic feet of air can be conditioned for burning of the experimental fires. Two wind tunnels will be used to study the spread of fire in beds of natural fuel under predetermined conditions of fuel moisture, wind, temperature, and relative humidity.

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ment for the measurement, treatment, and analysis of forest and range fuels, and for preparing fuels for experimental burning.

Fire physics and chemistry laboratories will provide facilities for conducting research on basic factors of combustion and fire extinguishment.

Forest fire meteorology research will be an important activity. Lightning will continue to be a prime target for research. Studies of lightning storms and precipitation patterns over the Northern Rocky Mountains will be possible using radar information collected by the U. S. Weather Bureau on an 8,000 foot peak a few miles from the laboratory. Radar scopes in the laboratory will monitor active storm systems within a 300 mile radius.

Special facilities at the laboratory include a technical research library on all phases of fire, a photographic laboratory for custom finishing, editing and handling of special research films, and fire equipment shops.

Mrs. Gifford Pinchot Dies

Cornelia Bryce Pinchot, who was well known to many American foresters and who was the widow of Gifford Pinchot, died September 9 at her home in Washington, D. C., at the age of 79.

Mr. Pinchot, who died in 1946, was the most noted conservationist of his period. Mrs. Pinchot had a deep concern for conservation also, although her interests ranged widely in public affairs, including politics, social welfare, and labor relations.

After Mr. Pinchot's retirement from public life, he resumed, on occasion, the delightful custom of holding meetings of the Washington Section, Society of American Foresters, in his home. Following his death, Mrs. Pinchot continued the custom until failing health intervened.

She was a woman of positive opinions and forthright in her public comments. As a delegate to the United Nations Scientific Conference on the Conservation and Utilization of Resources in 1949, she publicly criticized the secretary general for not giving the Conference policymaking responsibilities and authority to formulate recommendations to governments.

It was through her kindness that the Gifford Pinchot medal for outstanding services to forestry was made available to the Society of American Foresters. The medal is awarded periodically by the SAF Council.

With Mrs. Pinchot's passing an eventful era in the conservation of natural resources, including human resources, came to a close.

SAF Members Hold Informal Meeting at Forestry Congress

An informal meeting of SAF members attending the World Forestry Congress in Seattle was held September 2 at the University of Washington. Jay Greenfeld, chairman of the Puget Sound Section, presided.

A discussion of national Society and professional affairs was led by President Charles A. Connaughton, Councilman W. D. Hagenstein, and Henry Clepper, executive secretary. S. T. Dana described the program of the outdoor Recreation Resources Review Commission.

International Society for Tropical Ecology Formed

The JOURNAL has been advised of the formation of an International Society for Tropical Ecology with headquarters at 10, Chatham Lines, Allahabad, India. Dr. G. S. Puri is general secretary. The Society is interested in developing studies on tropical forestry and seeks membership and participation by American foresters. It is also interested in receiving contributions from American foresters for publication in its bulletin. Particular interest is expressed in papers from tropical regions of general interest in ecology, soils, and silviculture. There is, however, no bar to use of interesting material on temperate ecology and forestry.

Membership fees for the I. S. T. E. are as follows: individuals, Rs. 15/- annually, plus Rs. 5/- admission fee; institutions, Rs. 20/- annually, plus Rs. 5/- admission fee.

Industrial & Private

Utah Forester Named to Western Pine Post

Martin E. Craine, formerly deputy state forester of Utah, has been appointed forestry staff assistant for the Western Pine Association in Portland, Ore., it has been announced by Ernest L. Kolbe, chief forester of the Association.

Craine, a 1951 graduate of Utah State in forest management, served Utah two years as assistant state forester and two as deputy. In the latter post he was administrative head for fire protection.

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In between two service periods in the Salt Lake City office, Craine was extension forester at Iowa State College, Ames, Iowa. His first forestry job was with the Missouri Conservation Commission.

During World War II Craine served as an aircraft carrier officer.

In his new work Craine will help supervise the Western Pine tree farm program in 12 states, working closely with Western Pine's staff of forest engineers stationed at various points in the region.

Railway Company Appoints New Forester

The appointment of Edward N. Locke, Jr., as forester of the Chicago and North Western Railway Company was announced today by William A. Kluender, director of the road's agricultural and resource development department, Chicago.

Although headquartered at Chicago, Locke is being assigned to work closely with the pulp, paper, and lumber industries in Wisconsin, Michigan, and Minnesota. He will also supervise the railway's own forestry programs in those states where the road has planted more than one million trees in recent years.

A graduate of the University of Michigan, Locke has been engaged in forestry work in Michigan and Wisconsin, and has been a forester with George Banzhaf & Company, Milwaukee, in recent months.

J. E. MCCAFFREY (left), vice president of International Paper Company, was honored recently by the American Pulpwood Association. A bronze plaque, citing his outstanding service to the organization, is shown being presented McCaffrey by J. A. Holekamp, APA field engineer. McCaffrey, who is in charge of woodlands operations, was president of the APA from 1950 to 1952, and is a member of the Advisory Council to President Eisenhower's Outdoor Resources Review Commission.

AFPI Names C. R. Batten as Denver Manager

Charles R. Batten has been appointed district manager for American Forest Products Industries, Inc., in Denver, Colo., according to C. A. Gillett, AFPI managing director.

Batten was formerly forester in the Agricultural and Resource Development Department of the Chicago and North Western Railway Co., Chicago.

As district manager in Denver, he will direct AFPI's forestry programs and educational activities in Colorado, Wyoming, South Dakota, Nebraska, and Kansas.

A native of Iowa, Batten is a 1950 forestry graduate of the University of Idaho. He was with Potlatch Forests, Inc., Lewiston, Idaho, for four years before joining Chicago and North Western.

Batten succeeds Alan Miller, who was transferred to the AFPI office in Tacoma, Wash.

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S. E. FOGELBERG

Traczewitz Succeeds Fogelberg in International Paper Post

A retirement and a promotion, involving the exchange of responsibility for management policy on International Paper Company timberlands in the South, has been announced by Earl Porter, Southern Kraft Division Woodlands Manager.

S. E. Fogelberg, chief forester since 1942, retired September 1. His duties were assumed by O. G. Traczewitz, assistant chief forester.

Mr. Fogelberg retired after more than forty years' experience in forestry and forest land management, eighteen of which were spent with International Paper Company. He is a native of Sweden and a graduate of the Royal Forest Institute in Stockholm. For five years, 1930 to 1935, he was a partner in Forest Managers, Inc., of Jacksonville, Fla. Before joining International in 1942, he was general manager of the southeastern operations of the Southern Resin and Chemical Company, Glen St. Mary, Fla.

Traczewitz is from Milwaukee, Wis. He is a graduate of the University of Michigan, holding both a B.S. and a Master degree in forestry. He joined International in 1941 as a timber cruiser in Sheridan, Ark.

As a lieutenant in the U. S. Navy from 1943 until 1946, Mr. Traczewitz took part in the allied invasion of Normandy, Southern France, and Okinawa, and for two years was commanding officer of an LST.

Since his return to the Company in 1946, he has served as administrative assistant, conservation forester, division forester, regional forester, and, since May, 1960, as assistant chief forester.

Schools

Two Named to Penn State Staff

Dr. Sanford D. Schemnitz has been appointed instructor in forestry at the Mont Alto branch of the Pennsylvania State University. He was formerly instructor in wildlife management at the University of Maine.

He holds bachelor of science degrees from the University of Wisconsin and the University of Michigan, the master of science from the University of Florida, and a doctor of philosophy degree from Oklahoma State University.

He has worked successively for the Michigan Department of Conservation, the New York State College of Forestry, the Florida Game and Freshwater Fish Commission, the Wisconsin Conservation Department, and the Minnesota Department of Conservation.

Wayne K. Murphey has been named assistant professor of wood utilization.

His appointment, effective September 16, fills the vacancy created by the resignation of Dr. William T. Nearn who has joined the research and development division of the Weyerhaeuser Co. in Seattle, Wash.

Murphey is a 1952 graduate of Penn State where he received both the B.S. and M.F. degrees in wood utilization.

He has served two years as a tech-

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nical engineer in the wood preservation division of the Koppers Co. Inc., and four years engaged in research in forest products at the Ohio Agricultural Experiment Station.

N. Y. College to Furnish Technical Assistance to Philippines

An assistance contract, designed to promote international cooperation and understanding, has been signed linking the College of Forestry of The University of the Philippines and the New York State College of Forestry.

The program is being sponsored and supported by the Philippine Republic and the International Cooperation Administration.

Under the terms of the three-year accord, the American college will furnish professional and technical assistance to the Philippine college.

It is expected that, during the three-year contract, a total of eight foresters will go to the Philippines and, at the same time, 15 young faculty members of the College of Forestry of The University of the Philippines will come to the U. S. to familiarize themselves with American forestry techniques and methods.

Dr. Hardy L. Shirley, dean of the College of Forestry, has announced that two faculty members were selected for two-year assignments in the Philippines to help fulfill the terms of the newly signed pact. One is a forestry information specialist; the other, an authority on photogrammetry. Departing for overseas posts in September were Floyd E. Carlson, professor of forest extension, Division of Forest Extension and Public Relations; and John C. Sammi, professor of forest management, Department of Forest Management.

Named campus coordinator for the international project is Dr. C. Eugene Farnsworth, professor and chairman of the Department of Silviculture. Dr. Farnsworth recently returned from a technical assistance mission in the Philippines after being there almost two years.

Penn Symposium Discusses Herbicides

On August 30-31, a symposium on "Herbicides and Their Use in Forestry" was held on the University Park campus of the Pennsylvania State University. In attendance were land managers from 13 states. The program featured speakers from govern-

THIS new Agriculture Building on the University of Missouri campus provides the newest in teaching and research facilities for the University's School of Forestry, says Dr. R. H. Westveld, director of the School. The Agriculture Building houses classrooms, research laboratories, and offices of the School of Forestry. Also housed in the building are the departments of horticulture and entomology, and the administrative and editorial offices of the University's Division of Agricultural Sciences.

The move into the new, air-conditioned, windowless facility was completed in July. Dedication ceremonies were planned for later this year.

mental and private land use agencies that delved into (1) Development, Present Status, and Characteristics of Herbicides, (2) Liability and Regulation Considerations, and (3) Forest Management Application—A. Wildlife Management, B. Silviculture. The silvicultural sessions covered the range of problems from nursery considerations through management objectives for varying stand conditions.

The program was sponsored by the Department of Forest Management in the School of Forestry at Penn State in cooperation with the U. S. Forest Service, the Pennsylvania Department of Forests and Waters, and the New Jersey Department of Conservation and Economic Development.

Industrial Forester Joins California Staff

Herbert C. Sampert, industrial forester and executive, has been appointed lecturer and associate specialist in the University of California's School of Forestry at Berkeley with responsibility for research forests.

U.C. Forestry Dean Henry J. Vaux announced that Sampert will manage forest lands operated by the School and also will lecture on the industrial aspects of forestry.

Sampert joined the faculty last February after occupying managerial positions in California and Oregon forest industry concerns for 20 years.

He had served as general manager of Dwyer Lumber and Plywood Company of Portland, Ore.; production manager of Elk Lumber Company of Medford, Ore.; and forester with the Collins interests at Quincy, Calif. He received his Bachelor of Forestry degree at Oregon State College and later earned a Master of Forestry degree from the New York State College of Forestry.

Three Graduate Fellowships Awarded at Minnesota

The awarding of three industry sponsored fellowships for graduate study has been announced by the University of Minnesota School of Forestry.

A Northwest Paper Foundation fellowship for $2,500 has been awarded to Myron Grafstrom, a 1960 graduate. He will carry on research studies on forest succession following the Baboura and Bemidji fires of 1959 and 1960. He will work under the direction of H. L. Hansen, professor of silviculture.

The Northwest Paper fellowship, now in its third year, has previously supported research studies on cone characteristics of jack pine, as related to management, and on the continuous forest inventory system.

George M. Blake, a graduate student at the School of Forestry since September 1959, has been awarded the $2,500 Wood Conversion Foundation graduate fellowship for 1960-1961. Purpose of the fellowship is to

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support research in the field of forest-tree genetics and tree improvement. The long range objective of this research is to improve the quality of aspen, which now makes up almost 40 percent of all pulpwood produced in Minnesota.

A Minnesota and Ontario Paper Company graduate research fellowship of $1,500 has been awarded to Richard C. Trochlil, a 1959 graduate. He will carry on research studies on application of aerial photography to forest inventory and classification. Now in its fourteenth year, the Paper Company's fellowship provides for forest research on state, county and privately owned lands, including those of the Minnesota and Ontario Paper Company. Research work by past fellowship winners has been in such fields as disease control in black spruce, development of reproduction in spruce and balsam fir, determination of logging damage in various types of tree stands, and continuous forest inventory techniques.

Public

National Forest Timber Cut Reaches Record High

Timber cut on the national forests jumped a billion board feet during fiscal year 1960, bringing the total harvest to a new high, the U. S. Department of Agriculture has announced.

Field offices of the Forest Service reported a cut of 9⅓ billion board feet of timber with a value of almost $148 million. This compares with a cut of 8⅓ billion board feet in fiscal year 1959 with a value of $114 million. Until 1959 the previous high was a harvest of 7 billion board feet in 1957. The 9⅓ billion board feet cut from national forests represents 14 percent of the total sawtimber harvested for the entire nation.

The Forest Service also sold more timber in fiscal year 1960, reporting an increase of 30 percent over 1959. This will be reflected in future harvests. Most of the increase is attributed to a long-term sale of 3 billion board feet of pulpwood in the Southwest. This sale, the largest ever made outside Alaska, will supply a new paper mill, producing a daily capacity of 150 tons of kraft paper and 210 tons of newsprint. The timber will come from the Colorado Plateau of Arizona and New Mexico in the Kaibab, Coconino, Sitgreaves, Apache, Tonto, and Cibola National Forests.

N. Y. Conservation Department Announces Mulholland Promotion

William D. Mulholland, a veteran of nearly 40 years of service with the New York Conservation Department, has been named to fill the post of assistant director of Lands and Forests, according to an announcement by Conservation Commissioner Harold G. Wilm.

Mulholland attended the State Ranger School at Wanakena, N. Y. Upon graduation he commenced work with the Conservation Department in May 1922, performing duties in timber cruising, forest surveys, and research. In 1927 he was promoted to superintendent of the newly created Bureau of Camps and Trails. From that year to the present, under Mulholland's supervision, the State Public Campsite areas have increased from 12, servicing some 55,000 people a year, to 38, where last year more than 1,160,000 people enjoyed the camping and other outdoor recreation facilities.

In his new position as assistant director of the Division, Mulholland succeeds Edward W. Littlefield who was recently promoted to assistant commissioner for Lands and Forests.

Multiple-Use Relations Branch Established

A new branch of Multiple Use Relations has been created in the U. S. Forest Service Division of Information and Education under Clint Davis, division director. The Branch will be headed by Thurman Trosper, formerly with the Branch of Program Planning.

The work of the Branch will be directed toward informational programs designed to acquaint the public of the

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purpose of the Multiple Use Act of June 12, 1960. The Branch will also develop new programs to inform the public of how multiple-use management activities are carried out on the National Forests.

New Division Established in Intermountain Regional Office

A Division of Watershed Management and Multiple-Use Coordination has been established in the U. S. Forest Service Intermountain Region. It will be headed by Leon R. Thomas, previously assistant regional forester in the Southern Region, Atlanta, Ga.

The Division of Water, Recreation and Lands will now become the Division of Recreation and Lands, remaining under the direction of John Herbert.

The new division will direct multiple-use coordination, watershed management, and soils, while Mr. Herbert's division will include recreation management, mining, land adjustments, and land uses.

Thomas graduated from San Jose State College in 1933 and received a degree in forestry from the University of California two years later. He began work with the Forest Service in 1934 as a field assistant in the California Region. During World War II he spent 26 months as a Signal Corps captain in England, France, and Germany.

Lynch Promoted to Washington Post

Donald W. Lynch, leader of the Boise Research Center of the Intermountain Forest and Range Experiment Station since 1955, has been promoted to the position of assistant director of the Division of Forest Management Research in the Washington Office of the U. S. Forest Service. He succeeds Richard D. Lane, who recently became director of the Central States Forest Experiment Station.

Dr. Lynch has conducted silvicultural and mensurational studies in several forest types in the Northern Rocky Mountains. He is a graduate of the University of Montana, and obtained his doctorate from Duke University in forest mensuration.

Hewlett Named Center Leader at Coweeta

John D. Hewlett, a research forester with the Southeastern Forest Experiment Station since 1956, has been promoted to research center leader of the Coweeta Hydrologic Laboratory, Franklin, N. C. As leader of this internationally known 5,600-acre outdoor laboratory, Hewlett will direct technical studies of hydrologic processes and how these can be beneficially modified by altering forest cover to increase water yields or achieve other watershed management aims.

A native of Philadelphia, Pa., Hewlett holds B.S. and M.S. degrees from New York State College of Forestry. He recently completed course work for his doctorate at Duke University.

Hewlett is a veteran of four years' service with the U. S. Army. Three of these years were spent in the European Theater during World War II. Before joining the U. S. Forest Service in 1956, he was employed by the engineering firm of Parsons, Brinckerhof, Hall, and McDonald in Virginia and Georgia, the Virginia Highway Department, and the Chemical Construction Company of New York City.

Glacier Peak Wilderness Established in State of Washington

Secretary of Agriculture Ezra Taft Benson on September 7 designated 458,505 acres in the State of Washington as the Glacier Peak Wilderness Area. The Suiattle, Agnes, and Phelps Creek Valleys are included in the area.

Establishment of the Glacier Peak Wilderness Area increases the total area of national forest land set aside for wilderness use to 1,384,596 acres in the State of Washington, and 14,660,234 acres in the nation. This area lies in the Wenatchee and Mt. Baker National Forests.

The Glacier Peak area has long been recognized as outstanding wilderness country and has been so managed. It straddles the divide of the Cascades in northern Washington for approximately 35 miles and averages 20 miles in width. Glacier Peak—10,528 feet in elevation—the fourth highest mountain in the State of Washington, is the central feature. Also within the wilderness area are over 30 other mountain peaks rising from 5,000 to 8,800 feet above the valleys. The new wilderness area, Forest Service officials said, is outstanding for its many glaciers, numerous lakes, and mountain scenery offering an unusual cross section of forest types and alpine flora.

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E. P. Furlow Heads Tariff Commission Division

Edward P. Furlow was appointed chief of the Lumber and Paper Division of the U. S. Tariff Commission on July 1, 1960, succeeding Joseph M. P. Donohoe who retired after 48 years' government service.

Furlow has been employed by the Tariff Commission since 1955—first as a commodity-industry analyst in forest products and later as assistant chief of the Lumber and Paper Division. Furlow served as a technical adviser from the Commission on the United States Delegation at the 1956 Tariff Conference held at Geneva, Switzerland. He also participated in the preparation of the forest products schedules of the Tariff Classification Study—a comprehensive revision of the Tariff Act of 1930, as amended, which will be released to the public on November 15, 1960.

From 1952 to 1955 Furlow was employed by the Virginia Division of Forestry as a service forester and was engaged in forest management and fire control duties. Prior to this, he was the West African representative, located in Takoradi, Ghana, for Fordom Forest Products Corporation of New York, purchasing logs, erotchwood, and lumber of mahogany and other species.

Furlow holds a B.S.F. (1949) and a M.S.F. (1950) from Purdue University. As an undergraduate he majored in general forestry; in graduate school he majored in utilization and minored in economics.

During World War II, he saw combat service with the 102nd Infantry Division in Europe.

H. C. Hiatt Retires

Retirement of Harlan C. Hiatt, widely known Northwest forester, was announced in September by J. Herbert Stone, U. S. Forest Service regional forester, Portland, Ore.

Hiatt, Oregon State graduate and full-time Forest Service employee since 1926, has been in charge of management plans and sale administration in the Regional Office Division of Timber Management.

The retiring forester is a charter member of the Pacific Northwest Log Rules Advisory Committee and served as secretary of the group for several years. He has served as Northwest representative of the Forest Service's National Log Grade Committee since its inception.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

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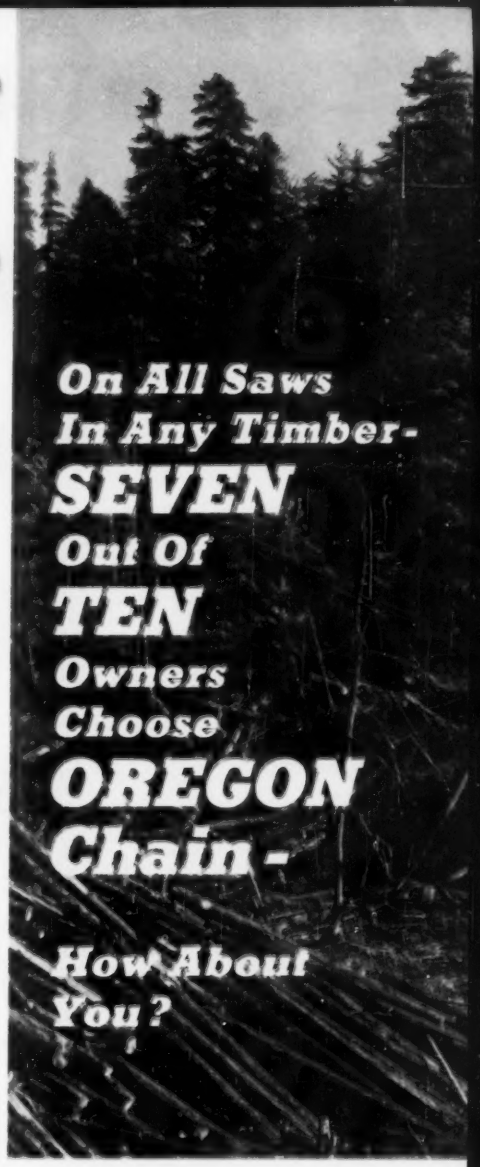
Wood Utilization, B.S., 1956, Pa. State. Age 26, married, one child. Five months experience as timber products engineer prior to military draft. Two years with U. S. Army in youth activities — complete November 1958. January 1959 to present as district Boy Scout executive. Desire position in public relations, personnel, timber procurement, or youth programs where background in forestry and basic interest in working with people would be beneficial.
Box V, Society of American Foresters, Mills Bldg., Washington 6, D. C.

Forester, B.S. 1960. University of Georgia. Age 27, married, one child, Veteran. One summer forestry experience, and one summer's experience in surveying and road layout. Desire relocation with large private industry or large consultant firm with chances for advancement. Anywhere in U. S. will be considered.
Box W, Society of American Foresters, Mills Bldg., Washington 6, D. C.

FORESTER—B.S. M.F. Yale. Ten years experience including forestry, logging, forest engineering and wood procurement; 8 years in South, 2 years in Midwest. Qualified for administrative responsibilities in above fields. Currently heading procurement for midwestern mill. Desire to relocate in South. Will accept position offering advancement. Comprehensive knowledge of sawmiling and pulp and paper mill operations.
Box X, Society of American Foresters, Mills Bldg., Washington 6, D. C.

Forester, B.S.F., M.C.M. & T., 1955. Correspondence course study in surveying, mapping, and photography for 2½ years. Age 34, married, family. Experience includes 3½ years in timber management with federal agency and four years of photogrammetric engineering with private company. Author of published article. Desire position requiring application of photogrammetry to forestry or other natural resource management.
Box Y, Society of American Foresters, Mills Bldg. Washington 6 D. C.

Forester, B.S.F., Michigan State University, desires employment as forester in foreign country, preferably non-English speaking. Willing to learn any language. Experience: Two years eastern Oregon with U.S.F.S. in stand improvement, erosion control, some rodent control. Incidental management activities included fire control and burn rehabilitation. Experience limited in latter two fields. Age 25, married, no children.
Box Z, Society of American Foresters, Mills Bldg., Washington 6, D. C.



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*Data from 1959 survey, "The Woodcutting Industry." Details on request.

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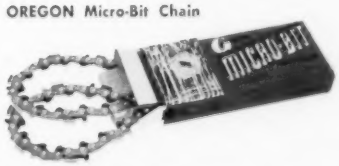

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